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### **KANSAS ENTOMOLOGICAL SOCIETY**

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# Kansas Entomological Society

Volume 20

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## THE NEARCTIC PTIOLINA (Rhagionidae—Diptera)

(Rhagionidae—Diptera)

D. ELMO HARDY and J. U. MCGUIRE<sup>1</sup>

*Ptiolina* Zetterstedt, 1842, Dipt. Scand., I, p. 226

*Tyollina* Walker, 1848, List Dipt. Brit. Mus., I, p. 220 (evidently an error in spelling)

*Eurytion* Jaennicke, 1867, Berl. Ent. Zeitschr., XI, p. 99.

This genus is not well known and is very poorly represented in collections. Most of the known nearctic species are from Canada, Alaska and the Northern United States. Except for records of *Ptiolina fasciata* Loew in Colorado the genus has not previously been reported from the Western States. This paper describes two new species from Washington and Oregon, one new species from New York and one from Alaska. Notes and descriptions of the known nearctic species are also given.

The genus is characterized by the short thick terminal style of the third antennal segment. The third segment is usually much longer than wide and is typically oval to conical in shape. All of the known species are dark colored and vary in size from 4.0 mm. to 9.0 mm. in length

Genotype: *Leptis obscura* Fallen, the first species, by designation of Frauenfeld, 1855, Verh. Zool.-Bot. Ges. Wien., Vol. 5, p. 497

### Key to species of *Ptiolina* Zetterstedt

- |  |                           |
|--|---------------------------|
| 1. Mesonotum with gray and black vittae  | 3                         |
| Mesonotum not vittate  | 2                         |
| 2. Posterior tibiae clothed with rather long erect hairs, especially on dorso-basal surfaces   | 11                        |
| Posterior tibiae with only short appressed pile  | 10                        |
| 3. Apices of abdominal segments with broad gray bands, bases brown to black  | 4                         |
| Abdomen unicolorous or nearly so, never conspicuously fasciated  | 5                         |
| 4. Median brown stripe extending to the scutellum although narrowed to a thin line on the posterior one third (fig. 5d). Mesonotum and scutellum rather sparsely covered with short black pile | <i>nigripilosa</i> n. sp. |
| Median stripe ending one third the length of the mesonotum from the scutellum (fig. 1b). Dorsum of thorax and scutellum densely covered with long pale pile                                    | <i>fasciata</i> Loew      |
| 5. Mesonotum with two rather narrow gray vittae  | 6                         |
| Mesonotum with three gray vittae, the median dark stripe is divided by a narrow gray line  | 7                         |

<sup>1</sup>Assistant State Entomologist and Graduate Student, respectively, Iowa State College, Ames, Iowa.

6. Chiefly gray pollinose, pile of palpi, lower part of head and femora pale. Median dark stripe of mesonotum very narrow on posterior one third of dorsum (fig. 9b). ..... **zonata** n. sp.  
 Chiefly subshining black with all pile black. Median dark stripe of mesonotum broad for its entire length (fig. 7b) ..... **obsoleta** Leonard
7. Dark areas of mesonotum shining brown, scutellum and abdomen chiefly shining, just faintly pollinose. Front of female polished. Antennal style very short, not equal in length to the third segment ..... **nitidifrons** n. sp.  
 Dark areas of mesonotum opaque or but faintly shining, scutellum and abdomen opaque. Front of female pollinose. Style equal or slightly longer than rest of antennae ..... 8
8. Third antennal segment conical, broadest near base and tapering to a point apically (fig. 4b) ..... 9  
 Third antennal segment oval, broadest in the middle and rounded apically (fig. 8a) ..... **vicina** n. sp.
9. Hind tibiae with rather long erect hairs, especially on the dorsal surfaces. Cubital cell closed, basal section of vein  $M_4$  present and about one half as long as the m-cu crossvein ..... **mallochi** n. n.  
 Hind tibiae with close appressed pile, no erect hairs. Cubital cell open in the wing margin, cell  $M_3$  pointed basally,  $M_3$  and  $M_4$  fork at m-cu crossvein ..... **majuscula** Loew
10. Mesonotum uniformly brownish gray pollinose, scutellum gray. Third antennal segment small sub-cordate. Small species, Length 3.0 mm. .... **mitis** Curran  
 Mesonotum velvety black, scutellum subshining, not thickly pollinose. Third antennal segment conical, broader and much longer than first and second segments. Somewhat larger species, about 5.0 mm. in length ..... **edeta** (Walker)
11. Third antennal segment subrectangular, (fig. 2a), square tipped, not tapering to a point ..... **grisea** Curran  
 Third antennal segment cordate to conical, tapering apically ..... 12
12. Females ..... 14  
 Males ..... 13
13. Stigma of wing large, brown and sharply defined, Mesonotum uniformly brownish gray or grayish brown, Scutellum grayish pollinose. Small species, 3.0 mm. in length ..... **augusta** Curran  
 Stigma concolorous with the membrane. Mesonotum dull blackish; scutellum subshining, not thickly pollinose.  
 Length 5.0 mm. .... **alberta** Leonard
14. Stigma large, brown and sharply defined. Small species, 3.0 mm. in length ..... **augusta** Curran  
 Stigma almost concolorous with the membrane.\* Larger species, 5.0 mm. in length ..... **alberta** Leonard

\* Female not definitely known but probably more pollinose than the male. See under description of species.

**Ptiolina alberta** Leonard

**Ptiolina alberta** Leonard, 1931, Can. Ento., 63, 250.

This species is related to *P. edeta* (Walker) and to *augusta* Curran. It is distinguished from the former by the long erect pile of the legs, especially that of the posterior tibiae and from the latter by its larger size, obsolete stigma and dull blackish body color.

**Male.** **Head:** Pile chiefly black that of lower face and labellum yellowish brown. Labellum, antennae and palpi black, the latter thickly black pilose. Third antennal segment conical, widest near base and tapering to the apex. Third segment approximately two times as long as the combined lengths of the first two. Style equal in length to the three antennal segments. **Thorax:** Mesonotum and scutellum uniformly brownish black, rather lightly pollinose. Pile black, moderately long and abundant. Halteres brown, stems yellowish. **Legs:** Brownish black, with long black pile, pile of posterior tibiae long and erect on dorsal surfaces. **Wings:** Uniformly grayish to brownish fumose, stigma concolorous with the membrane, not clearly defined. Cubital cell with a moderately long petiole, the petiole is equal in length to the basal section of vein  $M_4$ . **Abdomen:** Opaque brownish black, faintly subshining in some lights. Pile abundant, brownish to black. The genitalia have not been studied.

**Length:** Body, 5.0-5.5 mm.; wing, 5.2-5.7 mm.

**Female:** A female specimen on hand appears to be this species. It differs from the male in being more grayish pollinose, having the thorax and legs more brownish and the abdomen somewhat yellowish in ground color. The first abdominal tergite is yellowish pilose and the femora possess yellow brown hairs. The front is thickly gray pollinose and almost concolorous with the face. The front is two times as wide as one eye and is rather thickly covered with short black hairs.

**Type locality:** Banff, Alberta. Type in Canadian National Collection.

Specimens apparently belonging to this species have been studied from Camp 334, Alaska, Alsk. Eng. Comm., vii-9-21 (J. M. Aldrich). These were in the U. S. National Museum Collection, determined as *P. edeta* (Walker).

**Ptiolina augusta** Curran.

**Ptiolina augusta** Curran, 1931. Can. Ento., 63, 249.

This species is related to *mitis* Curran but is distinguished by the long erect hairs on the posterior tibiae, the sharply defined stigma in the wing and the more brownish pollinosity of the body.

**Male:** The following notes are taken from the original description. **Head:** The palpi and antennae are black. The third antennal segment is sub-cordate in shape constricted on the apical fifth. The style is longer than the third segment and tapers to the apex. **Thorax:** The thorax is grayish brown pollinose and black pilose. **Legs:** The legs are black, except for brownish tibiae. The posterior tibiae are clothed with long erect black hairs on the basal halves and shorter sub-appressed pile on apical portions. **Wings:** The wings are tinged with brown. The stigma is large, brown and sharply defined. The second pos-

terior cell is short petiolate at base. **Abdomen:** Black in ground color, with grayish brown pollen, dorsum only thinly pollinose. Pile black, erect on the dorsum and appressed on the venter.

Female unknown. Type locality: Natashquan, Quebec Type in Canadian National Collection.

### ***Ptiolina edeta* (Walker)**

***Spania edeta*** Walker, 1849. Lists Dipt Brit. Mus., 3, p. 489.

This species is not well known. The original description is very inadequate and from it the species cannot be distinguished from other related species. Curran\* characterizes the species as having the mesonotum without vittae and dull blackish in color; the scutellum subshining and the posterior tibiae covered with short appressed pile and no long erect hairs. Walker, in the original description, states that the body is deep velvet black in color. That the palpi and labellum are black. The third antennal segment conical, broader and much longer than the first and second segments. The legs black, clothed with short black hairs. Wings hyaline, somewhat darker along the anterior margin and the halteres piceous. Walker gives the length of the body as two lines (4.0 mm.) and the wings as four lines (8.0 mm.). No species of *Ptiolina* are known to the writers that have such long wings in proportion to the body length. It is very probable that Walker's measurements were not correct and that the wings of *edeta* are not twice as long as the body.

Type locality: St. Martins' Falls, Albany River, Hudson's Bay. Type in British Museum.

C. W. Johnson identified specimens as *P. edeta* from Mt. Washington, New Hampshire and Coquillett has recorded the species from Sitka, Alaska. Two specimens from the U. S. National Museum Collection, Camp 334, Alaska, determined as *P. edeta* (Walk) are apparently the same as *P. alberta* Leonard.

### ***Ptiolina fasciata* Lw.**

(Figs. 1a-d)

***Ptiolina fasciata*** Loew, 1869, Berl Ent Zeits., 13, p. 164.

The species at hand more nearly fits the original description of *P. fasciata* Lw. than the other species in this complex and is probably the same as that which Loew had before him. It has not been possible to study material from the type locality. The nearest to a northern Canada habitat was represented by a specimen from Banff, Alberta. This agreed in all details with specimens from Colorado.

*P. fasciata* is readily separated from *nigripilosa* n. sp. by the dense pale pile of the mesonotum and scutellum and by the short median stripe on the mesonotum (compare figs. 1b and 5d).

**Male.** Chiefly brown to black species covered with rather dense whitish pile. **Head:** Eyes narrowly joined on the front, this junction is less than the length of the ocellar triangle. Frontal triangle long and narrow, black on up-

\* 1931. Can. Ento. 63, 249.

per portion, gray pollinose below. Sides of face tapering from the lower eye margins to above antennae, the face and front V shaped as viewed from below. Lower portion of face and palpi densely haired. Median portion of the face with a few short hairs between the antennae and the mouth-parts. Ocellar triangle with numerous slightly yellowish hairs. Antennae black, third segment oval, longer than wide and slightly longer than the first two segments combined. The style is about two times the length of the third segment and tapers rather gradually from its apex (fig. 1a). Second antennal segment with a ring of hairs at the apex. **Thorax:** Brownish black in ground color with dense whitish pile on the mesonotum, scutellum and the propleurae. The anterior basalar sclerite, the upper part of the mesopleurae and the lower part of the sternopleurae are thinly pilose. The mesonotum has three broad opaque brown stripes, set off by gray lateral margins, a broad gray spot in the middle on hind margin and two narrow gray vittae which extend from the posterior one third of mesonotum to the anterior margin. The lateral brown stripes extend the entire length of the mesonotum. The median stripe ends just opposite the anterior margin of the wing base (fig. 1b). Scutellum gray pollinose, the margin blackish. **Legs:** Chiefly black except for narrow yellow apices of femora and the brownish bases of the front and middle tibiae. All of the leg vestiture yellow to whitish. Loew stated that the feet of *fasciata* were shorter and stouter than in other species, the tarsi of the specimens at hand appear to be normal. **Wings:** Slightly fuscous, stigma not distinct. Venation very similar to *P. nigripilosa* n. sp., cell  $M_2$  is acutely pointed at its base and the basal section of vein  $M_1$  is one half to one third the length of the m-cu crossvein. Two specimens from Colorado had the cubital cell open wide in the wing margin. **Abdomen:** Apical halves to three fourths of segments gray pollinose, basal portions opaque brown. Pile long, rather dense and yellowish white. **Genitalia:** The ninth tergum is two times as wide as long, the hind margin is straight (when the sclerite is flattened out). The anterior margin is moderately concave, the cleft extending about one fourth the length of the sclerite. Cerci longer than wide (fig. 1c). Coxopodite cleft slightly over one half its length. Harpagones slender and strongly curved (fig. 1d).

Length: Body and wing 4.8 mm.

**Female:** The female of this species has not previously been described. The following description is of a specimen from the C. W. Johnson collection, labeled Colo., 2024. It differs from the male as follows: The front is one and one half times as wide as one eye. The front is gray with a faint brownish tinge. Front with a transverse groove, narrowly interrupted in middle, extending just above the antennae. The legs are chiefly brownish black, the knees narrowly yellowish. Cell  $m_1$  has a very long petiole, the petiole is slightly longer than the length of the m crossvein. The cubital cell is open in the wing margin (this is also the case in some of the males that have been observed). The cerci appear to be oval in shape and not elongate as in some other species.

Length: Body, 5.0 mm.; wings, 5.4 mm. Type locality: Hudson's Bay Territory. The type has been lost. Dr. Jos. Bequaert reported that only the pin and labels remain in the Museum of Comparative Zoology. In 1930 Leonard reported that a single wing remained.

The specimens studied were from the following localities: Gunnison Co., Colo., 7-20-39 (Sparrow); Three specimens labeled Colo. 2158, 2024 U. of K. lot 291, also Banff, Alberta, vii-23-32 (C. B. Garrett).

***Ptiolina grisea* Curran**

(Fig. 2a)

***Ptiolina grisea* Curran, 1931, Can. Ento. 63, 251.**

This species is characterized by the subrectangular third antennal segment, the very thick sharply pointed style, the long erect pile on the posterior tibiae and the absence of vittae on the mesonotum.

The following notes are added to Dr. Curran's description. **Male. Head:** The third antennal segment is two times as long as the first two combined. The third segment is much broader than the second and tapers but slightly. The apex of third segment transverse with a slight indentation at the point of junction with the style. Style about equal to the combined length of the second and third antennal segments. Style very thick and swollen slightly in the middle, tapering to a sharp point apically (fig. 2a). **Thorax:** The thorax of the specimen at hand is greased so the pattern of the mesonotal vittae is not visible. The pleurae are bare except for dense pile on the propleurae and the anterior basalar sclerites. **Wings:** Faintly tinged, stigma distinct, elongate and brownish. Base of  $M_2$  three fourths as long as the m crossvein. Base of  $M_1$  about one half the length of m-cu. Cubital cell with a short petiole. **Abdomen:** The genitalia have not been dissected and all the structures have not been clearly seen. The coxopodite is deeply cleft, the broad V shaped cleft appears to extend nearly to its base. The Harpagones are slender and folded inwardly, plainly visible from a dorsal view. Harpagones brown at bases, yellow at apices.

Female unknown.

Type locality: Mt. Washington, New Hampshire. Type in the American Museum collection. The writers have studied a paratype male. The above notes were made from this specimen.

***Ptiolina majuscula* Loew**

(Figs. 3a-c)

***Ptiolina majuscula* Loew, 1869, Berl. Ent. Zeits., 12, p. 165.**  
***Spania majuscula* Aldrich, 1905, Cat. N. Amer. Dip., p. 217.**

This species is distinguished from other *Ptiolina* which have the mesonotum vittate by having the median brown to black stripe of mesonotum divided by a narrow line of gray; the cubital cell open in the wing margin; the third antennal segment conical, broadest at base, tapering to a point apically and the antennal style as long or longer than the rest of the antennae (fig. 3a). The species is blackish in ground color and wholly gray pollinose except for the three dark brownish stripes on the mesonotum. The wings have an irregular band of darker coloring extending through the center from the base of the stigma.

**Male.** Almost entirely gray pollinose species covered with short black pile on the upper portion of head, thorax and tip of abdomen and with yellow pile on face, femora and basal portion of abdomen. **Head:** Antennae black, first and second segments about equal in length and covered with black hairs. Third segment equal to the combined length of the first two. The style is about equal to the rest of the antennae. Palpi very well developed, thickly covered with long thick black hairs on apical segment and with yellow white hairs basally. The palpi are as long as the face and two times as long as the labellum. **Thorax:** The lateral brown vittae of the mesonotum are distinctly interrupted with gray at the suture. None of the brown vittae reach the posterior border of the mesonotum, the median pair end at about the posterior three fourths of the mesonotum and the lateral vittae extend nearly to the posterior calli (fig. 3c). Scutellum entirely gray. Knobs of halteres brownish black, stems yellowish. **Legs:** Chiefly brown to black. Tibiae and tarsi with very short dark hairs, femora and coxae with considerable long yellow pile. **Wings:** The wings are yellow-brown fumose with a slightly darker band extending across the middle. Stigma obsolete. The cubital cell is open in the wing margin. The basal section of vein  $M_2$  is about one fourth the length of the m crossvein and the basal section of  $M_4$  is one fourth the length of the m-cu crossvein. **Abdomen:** Entirely gray pollinose, faintly subshining in ground color. The genitalia have not been dissected.

Length: Body and wing, 7.0-7.7 mm.

**Female.** The front is yellow gray pollinose, covered with short black hairs on the upper three fourths and with yellowish hairs on the lower portion of the front. Front one and one third times wider than the width of one eye. The palpi are well developed, equal in length to the antennae, including style. The cubital cell is open very wide in the wing margin, the space between the tips of  $Cu_1$  and  $Cu_2$  is about three fourths the length of the m crossvein (fig. 3b).

Length: Body and wing, 8.0-9.0 mm.

The species figured by Curran\* is very probably not *majuscula*. The third antennal segment is much more broad and the palpi apparently shorter than in the specimens which the writers have studied.

Type locality: Hudson's Bay Territory.

Type in Museum of Comparative Zoology at Cambridge.

Specimens have been studied from the following localities in Alaska: Popoff, Island, July 10, 1899 (T. Kincaid) (This specimen was designated as the Allotype by Leonard); Fairbanks, July 2, 1921 (J. M. Aldrich); Camp 334, Alsk. Eng. Comm. July 9, 1921. (J. M. Aldrich); Healy, June 26, 1921 (J. M. Aldrich); Anchorage, June 11, 1921 (J. M. Aldrich); Hurricane, June 18, 1921 (J. M. Aldrich); Valdez, June 8, 1921 (J. M. Aldrich) Mt. McKinley Pk. 4-13-38 (G. P. Englehardt) and Nenana, July 5, 1921 (J. M. Aldrich).

\*1934, The Families and Genera of North American Diptera, p. 158, fig. 5.



***Ptiolina mallochi* new name**

(Figs. 4a-b)

***Ptiolina arctica* Malloch** (nec Becker), 1923. North American Fauna, 46: 181-182. This name is preoccupied by *P. arctica* Becker, 1921, Zeitschr. Wiss. Insektenbiol. Neue Beitr. Z. Syst. Insektenkunde, 2: 62.

This species appears to be closely related to *P. alberta* Leonard but is distinguished by the vittate mesonotum and the broad palpi.

The following notes are taken from the original description and from the examination of a paratype specimen.

**Male. Head:** Eyes joined on the front for a short distance, widely divergent posteriorly on sides of face. Basal two antennal segments short, subequal. Third segment of antenna missing in the type male. Palpi broad and densely haired. **Thorax:** Brownish black in ground color, gray pollinose on the sides and yellowish brown pollinose on the dorsum. Mesonotum fasciated but the fasciae are not as conspicuous as in other species of this group. All of the specimens of the type series were in poor condition and the mesonotal pattern is rather difficult to discern. The median dark brown stripe is very narrowly divided by a faint yellowish line of pollen. A broad yellowish brown stripe extends on each side from the humeri and anterior margin of the mesonotum to the suture, then turns and extends along the suture to the lateral margins. Lateral margins gray, leaving a dark brown spot on each side of mesonotum just behind the humeri (fig. 4a). Scutellum subshining in ground color, dusted with yellow-brown pollen. Posterior calli yellowish. Halteres yellowish brown. **Legs:** Moderately stout, coxae and femora clothed with long yellow pile, posterior tibiae with moderately long, erect black bristles, especially on the dorsal surface. **Wings:** Grayish to brownish fumose, stigma not well defined, just slightly darker than the membrane. Basal section of vein  $M_2$  short, about one third as long as the m crossvein. The basal part of vein  $M_4$  is approximately half the length of the m-cu crossvein. The cubital cell is closed right at the wing margin and has no petiole or but a very short one at its apex. **Abdomen:** Brownish black in ground color and densely covered with brown pollen. First tergum with long yellow pile, the rest of abdomen with shorter brown to black pile. **Genitalia:** Malloch states that the harpagones are stout, symmetrical, rounded apically and not hairy.

**Female.** Front brownish yellow pollinose, with rather sparse, short black hairs. Front approximately one and one half times wider than one eye. The third antennal segment is rather long pointed, it is two times as long as its greatest width and is nearly two times the combined lengths of the first two segments. The style is just slightly longer than the third segment (fig. 4b). Segments one and two have a few short hairs on apical portions.

Length of both sexes 7.0-8.0 mm.

Type locality: St. George Island, (Pribilof Islands), Alaska.

Type in the U. S. National Museum Collection.

The writers have studied a paratype female.

*Ptiolina mitis* Curran

*Ptiolina mitis* Curran, 1931, Can. Ento., 63, 249-250.

This species is closely related to *P. edeta* (Walker) but is distinguished by its brownish gray color and smaller size. Following is the original description:

**"Male.** Head black, gray pollinose, black pilose; vertical triangle thinly pollinose and pilose. Palpi black. Antennae black, the third segment rather small, sub-cordate, with several hairs on the basal half; style shorter than the third segment, thick, distinctly two segmented, the basal segment with a single hair at the apex above, the second ending in several hairs. Thorax gray pollinose, the disc of the mesonotum more brownish; hair black; pleura bare, the propleura pilose. Legs black or brownish, thinly pollinose; hair short, appressed on the tibiae. Wings pale brownish gray, the stigma pale brown, not sharply defined; second posterior cell angulate at the base, not petiolate. Squamae brownish and with blackish fringe. Halteres reddish brown. Abdomen black, cinereous pollinose, black haired. The pollen is inclined to be more brownish in the middle of dorsum."

Length: 3.0 mm.

Female unknown.

Type locality: Natashquan, Quebec. Type in Canadian National Collection.

*Ptiolina nigripilosa* n. sp.

(Figs. 5a-d)

This species is related to *P. fasciata* Lw. by having the abdomen fasciated with gray. It is distinguished by the short black pile of the mesonotum and scutellum; by the bare meso and sternopleurae; the short, round, third antennal segment; the difference in the pattern of the mesonotal vittae and the male genitalia.

**Male.—Head:** Pile of palpi, lower face and occiput pale, upper face bare. Front opaque brownish, face gray. Antennae brownish black. First segment very small, second two times as long as first. Second segment with a ring of short dark hairs near apex. Third segment short and round, scarcely longer than its greatest width and but little longer than the combined length of one and two (fig. 5a). Style two and one half times as long as segment three. Lower angle of face prominently projecting below the eye margin from lateral view. **Thorax:** Opaque brownish black in ground color. Mesonotum and scutellum rather sparsely covered with short black pile. The pleurae are bare except for the propleurae and for a few short hairs on each anterior basalar sclerite. **Mesonotum** with three brownish stripes, marked off by two gray vittae. The median brown stripe extends the full length of the dorsum, this is strongly attenuated on the posterior one third to one fourth and extends to the scutellum as a thin line (fig. 5d). The sides of the mesonotum are gray and the lateral brown stripes are dissected with grayish at the suture. The scutellum is opaque brownish with a faint tinge of gray. Knobs of halteres black, stems yellow brown. **Legs:** Femora brownish black with the apices narrowly yellow. Tibiae yellowish to yellow brown, Basitarsi yellow brown, other subseg-

ments blackish. **Wings:** Faintly fuscous, stigma light brown and elongate. Vein  $R_2$  terminates in the costa just beyond the forking of  $R_1$  and  $R_{4+5}$ . Veins  $M_1$  and  $2$  fork at or slightly beyond the m crossvein, vein  $M_2$  without a basal section and cell  $M_1$  often with a short petiole at base. Basal section of  $M_1$  about half the length of the m-cu crossvein. Cubital cell with a short petiole. **Abdomen:** Opaque brown in ground color with broad gray bands across the apical margin of each segment. Pile of abdomen yellow, longest on the sides. **Genitalia:** Ninth tergum two times as wide as long, with a small broadly V shaped cleft in middle of posterior margin. Anterior margin of tergum deeply V shaped, the cleft extending about one-third the length of the segment. Cerci almost round, as wide as long (fig. 5c). Coxopodite broad and short, distinctly wider than long, the cleft extending about three fifths the length of the coxopodite on the hind margin. Harpagones slender, not strongly curved, apices rather sharply pointed (fig. 5b).

Length: Body and wings, 4.0 mm.

**Female:** The female differs from the male in being of slightly larger size, having the thoracic vittae and the scutellum more distinctly gray, the mesonotum and scutellum almost bare and the wings more hyaline. The front and face are gray pollinose with a small amount of brownish pollen in the middle of the front. Middle of the front slightly gibbose with a median indentation extending through the gibbosity from the antennae to just before the ocellar triangle. Front with a few short dark hairs sparsely scattered over the lower portion.

Length: Body, 5.0 mm; wings, 5.4 mm.

Holotype male: Irving, N.Y., VII-22-17 (M. C. Van Duzee). Allotype female: Gowanda, N.Y., 6-15, 1913 (M. C. Van Duzee). Four paratypes: one male, same locality as type; one female and two males, Lancaster, N.Y., VI-28, 1908 and VI-1918 (M. C. Van Duzee).

Holotype, Allotype and two paratypes have been returned to the American Museum of Natural History. One paratype has been deposited in the United States National Museum and one in the Snow Entomological Collections.

### ***Ptiolina nitidifrons* n. sp.**

(Figs. 6a-c)

This species is related to *P. majuscula* Lw. and *vicina* n. sp. by having three gray vittae extending down the mesonotum. It is distinguished from all the known species of *Ptiolina* by being chiefly shining, very lightly pollinose. The front of the female is polished brown on the upper four fifths. The antennae and the short palpi are also distinctive.

**Female. Head:** The polished portion of the front extends from just above the antennae to the vertex. It is bordered by a narrow line of grayish pollen along each eye margin and around ocellar triangle. The lower one fifth of the front is densely gray pollinose and concolorous with the face. The front has a distinct indentation running longitudinally from between the antennae to the median ocellus. This indentation is very faintly pollinose in some lights and indistinctly divides the front into two polished areas (fig. 6a). The front is

sparcely covered with short black hairs and is two times as wide as the width of one eye on a mid line. Face densely gray pollinose, with rather short yellow pile on lower portion. Sides of face with longitudinal striations. Pile of lower occiput yellow, that of upper portion and vertex black. Antennae short and stout, chiefly black in color but with a slight yellowish tinge on segments one and two. Segments one and two approximately equal in length. Segment one bare, two with an apical ring of short black bristles. Third segment about two times as long as the combined lengths of the first two, broadest at basal one third and narrowing slightly toward the apex. Apex blunt, its width being about equal to that of the second antennal segment. Style short and thick, it is much shorter than the third segment (fig. 6c). Palpi small, black in color with black hairs on the apical segments and yellowish hairs basally. **Thorax:** Shining brown in ground color, rather lightly gray pollinose. The mesonotum has two median shining stripes, and two shining spots on each side, these are set off by the pollinose areas. The two median stripes are divided by a narrow pollinose line and the lateral spots are separated by a broad line of pollen extending along the suture (fig. 6b). The scutellum is shining brown with a light covering of pollen. Mesonotum covered with short black hairs, these are longer on the hind portion. Scutellum rather densely covered with moderately long black hairs. Stems of halteres yellow, knobs brown. **Legs:** Brown, all pile brown to black. Hind tibiae with rather long erect bristles extending down the dorsal surfaces. **Wings:** Lightly brownish fumose, stigma concolorous with the membrane and not differentiated. Basal section of vein  $M_2$  half as long as the  $m$  crossvein. In the paratype specimen the basal section is lost, the fork is at the crossvein. Basal section of  $M_1$  very short, about one fifth to one sixth as long as the  $m$ -cu crossvein. Cubital cell closed in the wing margin but not petiolate. **Abdomen:** Shining brown in ground color lightly gray pollinose, covered with short black hairs. Cerci long and slender, they are three times as long as wide.

Length: Body, 5.0 mm.; wing, 5.5 mm.

Holotype female: Camp 327 Alaska, Alsk. Eng. Comm. VII-13, 1921 (J. M. Aldrich). One paratype female: Glen House, N. H., Aug. 21. (H. Skinner).

Type returned to the United States National Museum. Paratype returned to the Philadelphia Academy of Natural Sciences.

### ***Ptiolina obsoleta* Leonard**

***Ptiolina obsoleta* Leonard, 1931. Can. Ento., 63; 250-251.**

(Figs. 7a-b)

This species is related to *P. zonata* n. sp. It is distinguished by being chiefly subshining black with all pile black. The median vitta of the mesonotum is broad for its entire length, not narrowed posteriorly as in *zonata*. The following notes were made on the type. **Male. Head:** The type has been damaged and only the mouthparts and a shell of the head remain, the rest of the head has been eaten by museum pests. The palpi are well developed and appear more clavate than in most species. The palpi and face are covered with dense black hairs. **Thorax:** The mesonotum and scutellum are densely covered with mod-

erately long erect black pile. The mesonotum has a broad median dark vitta and two gray vittae extending longitudinally. The dark brownish lateral margins of the mesonotum are interrupted by gray pollen along the suture (fig. 7b). The tegulae of wings are covered with long black pile. **Legs:** The legs of the type are subshining black, with but a faint indication of brown on the tibiae and tarsi. **Wings:** Pale brownish, stigma yellow-brown almost concolorous with the membrane. Vein  $R_3$  ends well beyond the fork of  $R_4$  and  $_{5+6}$ . Cell  $R_3$  (first submarginal) narrow at base and very narrow at the point where  $R_1$  branches from  $R_3$ , at this point the cell is about one half as wide as the length of the r-m crossvein. Vein  $R_{1+2}$  branches slightly below the branching of the medius. The basal section of  $R_{4+5}$  is about one and one half times as long as the r-m crossvein. The fork of  $R_4$  and  $R_5$  is situated well before the forking of  $M_1$  and  $_{2+3}$  and the second section is slightly less than half of the length of  $R_5$ . Vein  $R_5$  ends above the wing apex and the section of costa between the tips of  $R_4$  and  $R_5$  is shorter than that between  $R_5$  and  $M_1$ . Basal section of  $M_{1+2}$  equal in length to the r-m crossvein,  $M_1$  and  $_{2+3}$  forked at or slightly beyond the junction of the m crossvein,  $M_2$  without a basal section as in the other species. Median crossvein long, about equal in length to the basal part of  $M_{3+4}$ . Cubital cell with a short petiole (fig. 7a). **Abdomen:** Dull black, very faintly shining in ground color. Abdomen rather densely covered with black pile. The genitalia are rather inconspicuous. The harpagones appear to be very small and poorly developed. The type was not dissected and the structural details could not be observed.

Length: Body and wing 4.4 mm.

Type locality: Michigan Agri. College.

Type in American Museum collection.

The writers have studied the type.

### *Ptiolina vicina* n. sp.

(Figs. 8a-c)

This species is related to *majuscula* Loew. It is characterized by having the third antennal segment broad and rounded not gradually tapering to a point as in *majuscula*. The wing venation differs as follows: the cubital cell is closed and petiolate and the fourth posterior cell ( $M_3$ ) is not narrowed basally, the basal section of vein  $M_4$  is equal to the length of the m-cu crossvein. The scutellum is densely gray pollinose, not shining. The palpi are shorter, reaching only two-thirds the distance from the mouth to the base of antennae. The front is very thinly pilose, with very few short hairs. The legs are black, not brownish yellow.

The specimen which Curran has figured\* as *P. majuscula* differs from Leonard's redescription<sup>1</sup> of the type in having the cubital cell closed and petiolate. The wings of the species at hand differ from Curran's figure as follows: the second vein ( $R_3$ ) curves gradually into the costa, not abruptly curved; the distance between the end of  $R_4$  and  $R_5$  is just slightly longer than

\*1934. North Amer. Diptera., p. 159, fig. 9.

<sup>1</sup>1930. Mem. Amer. Ento. Soc., No. 7; 174-176.

that section of costa between Sc. and  $R_{1+2}$ , this is twice as long as Curran's figure; veins  $R_1$  and  $R_5$  branch well before the end of  $R_3$  and before the fork of  $M_1$  and  $M_2$  instead of opposite these forks as in Curran's figure; r-m crossvein is as long as the m-cu in Curran's figure it is less than one half the length of m-cu.

**Females.** In addition to the above characteristics the species is almost entirely gray pollinose. **Head:** The front is entirely gray and is one and one half times wider than one eye, at its narrowest point. The antennae are black, the first and second segments are about equal in length. The third segment is oval, broadest at or beyond the middle and rounded apically. The style is just slightly longer than the three segments combined (fig. 8a). Mouthparts, lower face, occiput and vertex possess rather coarse black pile. **Thorax:** Mesonotum with three opaque black stripes running longitudinally, the median stripe is divided two thirds its length by a gray vitta. None of the dark stripes extend the full length of the mesonotum, the two lateral ones are interrupted by gray areas behind the humeri and the median stripe ends in the gray area before the scutellum (fig. 8c). Humeri faintly yellowish. Propleurae covered with long black pile. Anterior basalar sclerite with just a few fine hairs, pleurae otherwise bare. Legs black, pile black. Halteres yellowish brown. **Wings:** Hyaline, just faintly fumose. Stigma indistinct. Most of the venation has been covered in the previous discussion. The basal portion of vein  $M_2$  is less than half the length of the m crossvein. The basal part of vein  $M_1$  is equal to the m-cu crossvein and the petiole of the cubital cell about one half as long as the m-cu crossvein (fig. 8b). **Abdomen:** Entirely brownish gray with scattered short black pile. Cerci three times as long as wide.

Length: Body 4.3 mm.; wings, 5.0 mm.

Holotype female: Anthony Lake, Oregon. 7-11-31 (H. T. Peters).

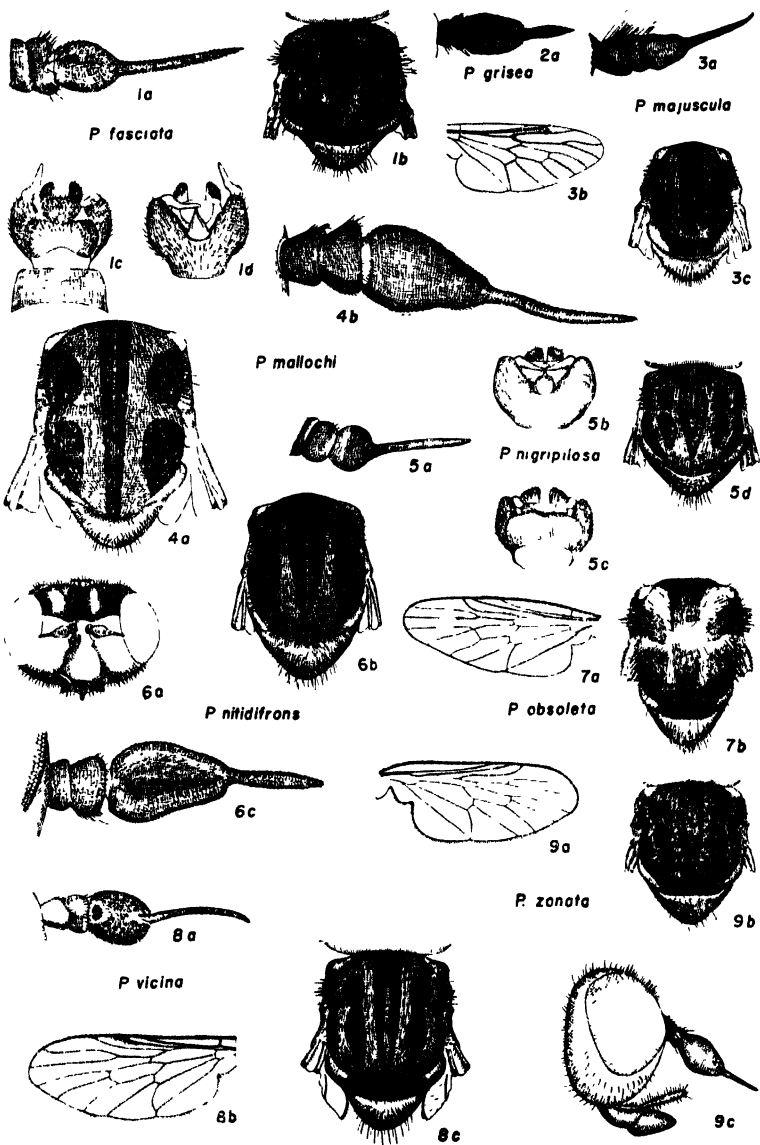
Type returned to the Snow Entomological Collections.

### *Ptiolina zonata* n. sp.

(Figs. 9a-c)

This species is related to *P. obsoleta* Leonard but differs in many respects. It is best distinguished by the chiefly gray pollinose body, the pale pile of the palpi, lower head and femora and the differences in the pattern of the vittae on the mesonotum (Compare figs. 9b and 7b). The antennae are probably distinctive for this species but since the type of *P. obsoleta* has the head damaged these structures cannot be compared.

**Female.** Chiefly gray pollinose species covered with rather short sparse pile. **Head:** Front rather strongly narrowed from occiput to antennae, the narrowest point is just one and one fourth times as wide as one eye. Front mostly gray but faintly shining medianly and with sparse short black hairs. Lower portion of the front with a small transverse groove extending from the eye margin to directly above the antennae on each side. Ocellar triangle with short black hairs. Face gray pubescent. Lower portion of face, mouthparts and lower occiput covered with long yellowish pile. Pile of upper occiput black. The antennae are black, the first two segments are rather thickly covered with black



hairs. The first antennal segment is twice as long as the second and the third segment is one and one half times the combined lengths of the first two. The third segment is conical in shape, widest near the base and tapering gradually to the apex. The style is about equal to the third segment in length (fig. 9c). **Thorax:** Entirely gray except for three brown vittae on the mesonotum. The median dark stripe is greatly attenuated on the posterior one third of the dorsum and extends to the scutellum as a very narrow line (fig. 9b). Scutellum densely gray pollinose. Pile of mesonotum and scutellum sparse and black. Pleurae bare except for propleurae, a few short hairs on lower portion of sternopleurae and for fine short hairs on the anterior basalar sclerite. The knobs of halteres black, stems yellowish. **Legs:** Entirely black except for a faint yellowish tinge at apices of femora. Pile of femora, hind coxae and all femora pale, that of mid coxae and rest of legs black. **Wings:** Nearly hyaline, just faintly fuscous. Stigma distinct brown and elongate. The basal part of vein  $M_2$  is present and is about one half the length of the m crossvein. The basal part of  $M_1$  is about equal to the length of the m-cu crossvein. The cubital cell has a very short petiole (fig. 9a). **Abdomen:** Brown in ground color, lightly dusted with gray and faintly shining. Cerci elongate.

Length: Body, 4.0 mm.; wings, 4.4 mm.

Holotype female: Puyallup, Wash., 7-5-35. (Jean Russell).

Type returned to the Snow Entomological Collection.

## NEW GENERA AND SPECIES OF MUSCOID DIPTERA<sup>1</sup>

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The present paper includes descriptions of three new genera and eight new species of Tachinidae from the United States. Types of all new species, except one as noted under the description, are in my collection.

### *Athanatus*, n. gen.

Allied to *Dolichodineria*, from which it differs in having bare arista; oral margin axis shorter than antennal; abdomen narrower than thorax; first posterior cell ending farther from wing tip; etc.

<sup>1</sup> Contribution No. 1000, Division of Entomology, Texas Agricultural Experiment Station

### Explanation of Plate

Fig. 1. *Ptiolina fasciata* Loew. a—antenna; b—thorax, c—male hypopygium, dorsal, d—male hypopygium, ventral.

Fig. 2. *P. grisea* Curran. a—antenna.

Fig. 3. *P. majuscula* Loew. a—antenna; b—wing, c—thorax.

Fig. 4. *P. mallochi* n. n. a—reconstructed thorax; b—antenna.

Fig. 5. *P. nigripilosa* n. sp. a—antenna; b—male hypopygium, ventral, c—male hypopygium, dorsal; d—thorax.

Fig. 6. *P. nitidifrons* n. sp. a—head; b—thorax; c—antenna.

Fig. 7. *P. obsoleta* Leonard. a—wing; b—thorax.

Fig. 8. *P. vicina* n. sp. a—antenna; b—wing; c—thorax.

Fig. 9. *P. zonata* n. sp. a—wing; b—thorax; c—head.

<sup>1</sup> Drawings not all made to the same scale.



Head fully one-fourth wider than high and subquadrate in lateral view; flat frontal profile nearly horizontal, over one-half longer than facial, latter barely receding downward; antennal axis equal head height and well above eye middle; clypeus moderately sunk, with median line slightly raised; epistoma as wide as clypeus, gently bowed forward and slightly produced downward; vibrissae well above oral margin; facial ridges subvertical, with several good-sized bristles on lower extremity; parafacials subequal clypeal width, hardly narrowed below, clothed with sparse short hairs on upper half or more; frontal bristles in single rows stopping at antennal base, not very large; orbitals and outer verticals absent in male; proclinate ocellars and erect inner verticals well developed; antennae approximated at base, first segment erect, moderately long, third segment rather broad and but slightly longer than second; arista bare, short, strongly thickened on basal half, second segment less than twice as long as wide; haustellum slender, three-fourths head height, labella small; palpi slender, barely thickened apically; cheeks two-fifths eye height; eyes bare, reaching vibrissal level; occiput strongly bulged, with a well defined groove extending diagonally upward from lower edge of eye towards vertex, clothed with coarse black hairs intermixed with finer pale ones on lower extremity. Thoracic chaetotaxy: acrostichal 1,2 (none near suture); dorsocentral, 3,3; intraalar 3; supraalar 3; presutural 1 (outer); notopleural 2; humeral 3; posthumeral 2; postalar 2; intrapostalar and pteropleural vestigial; sternopleural 2,1; scutellum with 2 long lateral (hind pair divaricate), 1 good-sized decussate apical and 1 smaller discal pair; prosternum bare; propleura sparsely haired; infrascutellum normally developed; postnotal slopes practically bare. Abdomen long ovate, first segment slightly longer than second, each with one pair of large erect median marginals besides two somewhat smaller lateral marginals; third and fourth segments each bearing a marginal row of erect strong bristles; no discals; sternites covered. Legs rather long but not slender; hind tibiae not ciliate; male claws and pulvilli elongate. Wings barely reaching beyond tip of abdomen, normal in shape; first vein bare, third with four hairs near base; bend of fourth vein rectangular, without stump or fold; first posterior cell open; hind cross vein oblique, joining fourth much nearer bend than small cross vein; last section of fifth vein barely one-fifth length of preceding; costal spine small.

Genotype: *Athanatus knowltoni*, n. sp.

***Athanatus knowltoni*, n. sp.**

**Male.**—Front at vertex 0.30 of head width (one specimen), slightly narrowed downward thence widening rapidly in facial angle; head black with subsilvery pollen, cheeks faintly reddish in ground color, clothed with black hairs on lower part; frontal vitta velvety black, equibroad to vertex and much wider than parafrontal; latter beset with sparse short black hairs outside frontal rows; antennae wholly black, about two-thirds length of face, third segment broadly rounded on apex; arista black, shorter than antennae; palpi reddish yellow, subequal length of antennae.

Thorax and scutellum black, thinly gray pollinose; notum not distinctly

vittate, moderately shiny in some views; calypters large, hind lobes rounded, opaque white.

Abdomen wholly black, rather uniformly gray pollinose above except on median line and narrow hind margins of last three segments; hairs on upper surface rather fine and mostly suberect; hypopygium rather large, black; inner forceps united and slender, with extreme tip bowed forward in form of a minute hook; outer forceps large, triangular, with short black hairs on outer side; fifth sternite broadly divided, lobes large, widely exposed, moderately clothed with mostly short black hairs.

Legs black, tibiae with a very slight reddish tinge in ground color; tarsi moderately stout, shorter than tibiae; mid tibia with row of four bristles on outer front side; claws and pulvilli equal or exceeding combined length of last two tarsal segments.

Wings gray hyaline; first posterior cell ending at least twice length of small cross vein before wing tip; stigmal section of costa about one-half length of poststigmal; small cross vein well before apex of first vein; epaulets black.

Length, 11 mm.

Holotype: Male, Logan Dry Canyon, Utah, June 18, 1944 (S. L. Wood). Donated by Dr. George F. Knowlton, for whom the species is named.

#### *Cryptomeigenia brimleyi*, n. sp.

**Male.**—Front at vertex 0.22 of head width, equibroad on upper half, widening but slightly to antennal base; sides of face and front with rather heavy pale yellowish pollen becoming grayer on lower part of cheeks; frontal vitta deep brown, gradually narrowed upwards, wider than parafacial on entire length; inner verticals erect, not large; frontals in a single row barely diverging anteriorly, two bristles below antennal base; ocellars proclinate, fine and rather long; antennae three-fourths length of face, basal segments yellow, third black, rather slender and slightly over twice length of second; arista practically bare, brownish, thickened and tapering on basal fourth, proximal segments very short; face moderately depressed, gray pollinose, its lateral ridges somewhat flattened bearing a few small hairs on lower extremity; vibrissae well above oral margin; parafacials hardly narrowed below; sparsely fine-haired on entire length; epistoma slightly elongate, as wide as clypeus and gently bowed forward from plane of same; proboscis short, labella large; palpi slender, yellow; cheeks black-haired, nearly one-third eye height; eyes bare; occiput gray pollinose, moderately clothed with pale hairs.

Thorax and scutellum black, rather heavily gray pollinose, notum with four black vittae, outer pair broken at suture and inner stopping shortly behind latter; pleura mostly black-haired. Chaetotaxy: acrostichal 3, 3; dorsocentral 3,3; intraalar and supraalar 3; presutural 1 (outer); humeral 2; posthumeral 2; postalar 2; intrapostalar differentiated; sternopleural 2, 1; pteropleural 1 (not very large); scutellum with 3 lateral (hind pair divaricate), 1 hairlike apical and 1 longish discal pair; prosternum black pilose; propleura bare; postnotal slopes setose.

Abdomen mostly black with a reddish tinge apparent above especially at sides, flat upper surface dusted with whitish pollen which changes from light to dark in opposite angles on either side of median vitta; basal segments each with one pair of median marginals, third and fourth with a marginal row, besides discal row on last; intermediate segments with one pair of good-sized discals; hairs on entire upper surface fine and erect but not very long; venter with some pale hairs on basal segment; hypopygium small.

Legs rather long and slender, reddish black basal segments paler; hind tibiae not ciliate, preceding pair with one weak bristle on outer front side beyond middle; fore tarsi distinctly longer than tibiae; claws and pulvilli hardly equal length of apical tarsal segment.

Wings long and rather narrow, subhyaline; first vein bare, third with two or three hairs near base; first posterior cell narrowly open shortly before wing tip; hind cross vein oblique, joining fourth nearer bend than small cross vein; latter before apex of first vein; bend of fourth obtuse, without stump or fold; last section of fifth vein short; epaulets yellow; costal spine minute; calypters tawny.

**Female.**—Front narrower than in male, at vertex 0.19 of head width; orbitals lacking and outer verticals not differentiated; abdomen moderately arched and convex above, fourth segment wholly red; intermediate segments with two pairs of discal bristles and first bearing one pair; anal orifice moderately large rounded above; genitalia terminating in a blunt-tipped ovipositor not adapted for piercing; claws and pulvilli distinctly shorter than last tarsal segment.

Length, 9 mm.

Holotype: Male, Raleigh, North Carolina, June 8, 1926 (C. S. Brimley). Allotype: Female, same data as type but dated July, 1931.

The holotype is returned to Dr. C. S. Brimley for deposit in the North Carolina Department of Agriculture Collection.

#### ***Cryptomeigenia crassipalpis*, n. sp.**

More heavily pollinose and grayer in general aspect than the preceding species, from which it differs mainly as follows:

**Female.**—Front at vertex 0.30 of head width, widening uniformly downward into facial angle; head pollen pale gray on reddish ground color, parafrontals slightly darker near vertex; outer verticals differentiated and two proclinate orbitals well above mid front; parafacials rather wide, clothed with fine pale hairs intermixed with coarser black ones on upper part; third antennal segment three times length of second; frontal vitta red, nearly equibroad and wider than parafrontal; cheeks pale-haired, two-fifths eye height; palpi nearly as long as antennae and considerably swollen on apical half; haustellum short but not very thick, labella moderately large. Thoracic vittae much less distinctly defined and pleura entirely pale-haired; prosternum pale pilose. Abdomen wholly black, with rather heavy but somewhat changeable gray pollen above showing a brownish shade in rear view; discals single on intermediate segments, none on first; genitalia without piercer,

short and largely retracted. Legs reddish yellow, tarsi darker or blackish. Male not known.

Length, 9 mm.

Holotype: Female, Babylon, L.I., New York, May 21, 1933 (F. S. Blanton). Paratype: 1 female. same data as type except dated May 31, 1934.

***Aphantorhapha atoma*, n. sp.**

A minute species, like the genotype, *A. arizonica* Townsend (Proc. U.S. Nat. Mus., 56, 586), from which it differs in having narrower cheeks and gray mesonotal pollen. There are also differences in the genitalia.

**Male.**—Front at vertex 0.40 of head width, equibroad to antennal base and face but slightly widened downward; parafrontal pale yellowish gray, less than half as wide as the red median vitta; two pairs of verticals and proclinate orbitals; ocellars widely divergent, proclinate; one frontal beneath antennal base; parafacial sublinear, whitish, bare except a few minute hairs on upper extremity; antennae as long as face, short basal segments reddish, third black, wide and about five times length of second; arista brownish, micro pubescent, thickened over halfway, second segment nearly one-fourth length of third; vibrissae on oral margin; facial ridges bare except a few small hairs on lower extremity; cheek whitish pollinose, about one-fourth eye height; haustellum rather slender, slightly over one-half head height, labella narrow, somewhat elongate; palpi pale yellow, short, widened at tip; eye bare, straight, nearly reaching vibrissal level; back of head slightly bulged at middle below, sparsely clothed with pale hairs.

Thorax black, wholly gray pollinose, not vittate above, transverse suture obsolete; scutellum black with extreme tip reddish. Chaetotaxy: acrostichal 2,3; dorsocentral 3,3; intraalar 3; supraalar 3; intrapostalar differentiated; pteropleural small; sternopleural 3; scutellum with 3 lateral (hind pair long and decussate), 1 short apical (hairlike, at times decussate) and 1 slightly differentiated discal pair; infrascutellum normally developed, postnotal slopes bare; prosternum setose, propleura bare

Legs mostly black, two basal segments of front and middle pair reddish yellow; mid tibia with one small bristle on outer front side below middle; hind tibia not ciliate; claws and pulvilli minute; fore tarsus longer than tibia.

Wings gray hyaline, twice longer than wide; first vein bare, second setulose nearly to small cross vein; last section of fifth vein fully two-thirds as long as preceding; first posterior cell just before extreme wing tip; hind cross vein retracted much nearer small cross vein than bend; costal spine vestigial; epaulets blackish; calypters opaque, white with a tawny tinge.

Abdomen ovate, short and somewhat flattened, black; last three segments gray pollinose above, posterior third of each appearing darker and subshiny in some angles; second segment with one pair of median marginals, third and fourth each with a marginal row; no discals; genitalia caudoventral, retracted; forceps short, united and tapered to an acute beak, nearly straight on ventral edge in profile with extreme tip bowed forward; accessory process

yellow, equibroad to middle thence slightly narrowed to rounded gently bowed tip; penis shiny black, curved forward and swollen at middle thence tapering apically to a simple rounded tip; fifth sternite broadly incised, lobes blackish, rather thickly beset with short black hairs.

**Female.**—Similar to male but the third antennal segment not so wide, reddish on inner side, three and one-half to four times length of second; abdomen slightly broader, anal orifice caudoventral, genitalia without piercer, retracted.

Length, 3.5-4 mm.

Holotype: Male, College Station, April 18, 1943 (H. J. Reinhard). Allotype: Female, same data as holotype. Paratypes: 25 males and 6 females, College Station, Texas, April-May, 1943-46 (H. J. Reinhard).

### **Crocinosoma, n. gen.**

Related to *Drepanoglossa* but readily distinguished by the much shorter front, longer face and larger antennae.

Head one-third wider than high, flat frontal profile barely sloped and three-fifths facial, latter vertical and parallel to occipital; antennal axis high above eye middle, one-half head height and subequal oral; clypeus barely depressed, equibroad, bowed forward on lower third; epistoma full width, short; vibrissae on oral margin near lower border of head; parafacial sublinear, bare; facial ridges somewhat flattened below, bearing a few minute hairs next to vibrissae; vertex nearly one-third head width in both sexes; frontals in a single row with anterior two beneath antennal base; female with two proclinate orbitals and differentiated outer verticals; ocellars proclinate; antennae as long as face, proximal segments short, third extra broad and fully ten times length of second; arista long, micro pubescent, moderately thickened to near middle, second segment short; haustellum well over head height, slender, gently bowed backward, labella small, divided; palpi slender, subcylindrical; cheek one-fourth eye height; eye bare, slightly oblique, reaching well short of vibrissal level; occiput slightly bulged below neck nad flattened above. Thoracic chaetotaxy; acrostichal 1,1 (none near suture); dorsocentral 2,3; intraalar 2; supraalar 1 (front and hind ones absent); presutural 1 (outer); humeral 2-3; notopleural 2; postalar 2; intrapostalar absent; pteropleural 1 (small); sternopleural 2,1; scutellum with 2 lateral, 1 or 2 weak discs and 1 minute or hairlike apical pair; infrascutellum normally developed, postnotal slopes, propleura and prosternum bare. Legs long and rather slender, weakly bristled; hind tibiae not ciliate; claws and pulvilli short in both sexes. Wings nearly clear, longer than abdomen; first vein practically bare (one setule near tip in one specimen), second with two to four hairs near base; bend of fourth vein broadly rounded, without stump or fold; first posterior cell narrowly open just before extreme wing tip; hind cross vein nearer bend than small cross vein; last section of fifth vein about one-fourth length of preceding; costal spine vestigial. Abdomen long ovate in male but nearly as wide as thorax in female; second segment with one pair of median marginals, third and fourth

each with marginal row; no discals; female genitalia not adapted for piercing; sternites covered.

Genotype: *Crocinosoma cornualis*, n. sp.

*Crocinosoma cornualis*, n. sp.

**Male and female.**—Head mostly pale in ground color with occiput darker above middle, pollen silvery white tinged with yellow on parafrontals; frontal vitta pale yellow, nearly as wide as parafrontal; antennae wholly red, third segment on front edge gently convex from base to tip in female and more strongly so on basal three-fourths in male; arista brown, palpi pale yellow; cheek pale-haired on lower border.

Thorax blackish and gray pollinose above, pleura including humeri mostly yellow in ground color and dusted with whitish pollen, pleural hairs black; scutellum red. Legs pale reddish yellow, tarsi very slender, thickly beset with short black hairs and appearing darker; mid tibia with one small bristle on outer front side near middle. Wings with a slight uniform brownish tinge, calypters translucent, tawny; epaulets pale yellow.

Abdomen translucent yellow somewhat darker at sides behind; last three segments with thin changeable whitish pollen above becoming thicker on narrow anterior margin of each; venter wholly black-haired.

Length, 5.5-6 mm.

Holotype: Female, College Station, Texas, June 29, 1944 (H. J. Reinhard). Allotype: Male, Austin, Texas, September 27, 1922 (Dr. R. H. Painter).

*Orasturmia*, n. gen.

Vibrissae scarcely differentiated as in *Avibrissosturmia*, but differing from the latter in having a shorter, much less prominent epistoma; antennal axis nearly one-third longer than oral; eyes not extending below level of vibrissal angle; other minor differences are listed below.

Head one-third wider than high, frontal profile moderately sloped and as long as receding facial, antennal axis at eye middle, about three-fourths head height; clypeus moderately sunk, equibroad, twice longer than wide; epistoma short, full clypeal width and but slightly bowed forward from plane of same; facial ridges broad and flattened, haired on lower third or less; vibrissae on oral margin hardly larger than postvibrissae, not decussate; haustellum short, stout; labella large; palpi stout, clavate; frontals in single rows becoming small or hairlike above mid front except one large reclinate prevertical pair, lowermost three or four upturned, beneath antennal base; inner verticals rather short, erect; ocellars moderately strong, proclinate; male without orbitals or outer verticals; frontal vitta gradually narrowed towards vertex, wider than parafrontal; latter rather thickly clothed with fine hairs; parafacial bare, subequal width of facial ridges inverted; antennae reaching nearly to oral margin, third segment almost half as wide as long and usually not over twice length of second; arista micro pubescent, long and slender, tapering on basal half, proximal segments short; cheek one-sixth eye height; eye nearly vertical, densely clothed with moderately long pale hairs; occiput flat, thickly pale-haired. Thoracic chaetotaxy: acrostichal 3,3; dorsocentral 3,4; intraalar 3; supraalar

3; presutural 2; posthumeral 2; humeral 4-5; postalar 2; intrapostalar strong; pteropleural 2-4 (none very long); sternopleural 1,1; scutellum with 3 lateral, 1 slightly smaller decussate apical and 1 good-sized reclinate discal pair; prosternum setose; propleura and postnotal slopes bare; infrascutellum normally developed. Abdomen at base slightly wider than thorax, narrowed apically and somewhat flattened above; basal segments without median marginals, third with a marginal row of rather short but stout bristles and entire upper surface of fourth segment beset with smaller bristles and erect bristly hairs; male hypopygium small, caudoventral. Legs moderately slender; hind tibiae with a row of closely set flattened cilia on outer hind side; male claws and pulvilli elongate. Wings long, reaching well beyond tip of abdomen; first vein bare; hind cross vein oblique joining fourth much nearer bend than small cross vein; first posterior cell open well before wing tip; last section of fifth vein short; costal spine vestigial.

Genotype: *Orasturmia vallicola*, n. sp.

*Orasturmia vallicola*, n. sp.

**Male.**—Front at vertex 0.21 of head width, equibroad on upper third thence widening to 0.38 of same, at antennal base; head with heavy gray pollen becoming thinner on upper part of parafrontals and on cheeks, which show blackish ground color in some views; antennae wholly black, elongate second segment lightly dusted with gray pollen; frontal vitta deep brown to black; palpi brown on basal third paler or reddish apically; cheeks thickly clothed with fine black hairs.

Thorax black gray pollinose; notum in a flat rear view showing five narrow but well defined vittae, median one widest and extending almost to base of scutellum; latier entirely reddish, lightly dusted with changeable whitish pollen, disc beset with short, erect, black hairs.

Abdomen black with an obscure reddish tinge in ground color on sides, thinly gray pollinose above to hind margin on last three segments but more heavily so on basal edge of the intermediate ones; genitalia black; inner forceps straight in profile narrow and united to blunt tip, moderately haired behind; outer forceps longer, smooth and shiny on widened base, tapering distally and bearing a short incurved barblike hook just beyond a distinct emargination on hind side and well before extreme tip; fifth sternite deeply incised, lobes blackish, moderately black-haired.

Legs subshiny black, not very strongly bristled; mid tibiae with three bristles on outer front side near middle; claws and pulvilli subequal combined length of last two tarsal segments.

Wings gray hyaline with a light brownish tinge on costal margin extending from base halfway to tip; third vein with two to four hairs near base; bend of fourth vein subrectangular, without stump or fold; epaulets black; calypters large, tawny white. Female unknown.

Length, 12.5-14 mm.

**Holotype:** Male, Brownsville, Texas, May 4, 1946 (Frank A. Cowan). **Paratypes:** 3 males, same data as type and 1 male, Hidalgo County, Texas, March 16, 1946 (Frank A. Cowan).

***Euceromasia neptis*, n. sp.**

Differs from the genotype, *E. spinosa* Townsend (Ins. Ins. Mens., 4, 20) by the presence of discals on the intermediate abdominal segments and the upturned apical scutellars.

**Female.**—Front gradually narrowed from antennal base to vertex, latter 0.28 of head width; head entirely subsilvery pollinose; frontal vitta deep brown to blackish, narrower than parafrontal; no outer verticals, inner pair long, straight; two reclinate and two proclinate orbitals; ocellars stout, proclinate; frontals in single row, moderately strong below mid front, three beneath antennal base; antennae subequal length of face, black, second segment obscurely reddish, over half as long as third; arista black, bare, thickened only near base, middle segment short; palpi bare, narrowed downward; facial ridges divergent, somewhat flattened, bristled on lower fourth; epistoma short, gently bowed forward from clypeal plane; vibrissae large, on oral margin near lower edge of head; cheek coarsely bristled, hardly one-fourth eye height; proboscis short, labella large; palpi somewhat flattened and hardly widened apically, reddish to brown; eyes practically bare, not quite reaching vibrissal level; occiput flat, clothed with pale hairs.

Thorax black, gray pollinose, with four dorsal vittae before suture and five behind; scutellum black, dusted with changeable gray pollen. Chaetotaxy: acrostichal 3,3; dorsocentral 3,4; intraalar 3; supraalar 3; postalar 2; intrapostalar strong; notopleural 2; presutural 2; posthumeral 2; humeral 3; sternopleural 4 (intermediate 2 often weak); pteropleural 1-2 (smaller than anterior sternopleural); scutellum with 4 lateral (intermediate 2 weak), 1 discal and 1 small decussate suberect apical pair; prosternum bristled; propleura and sides of postnotum beneath calypters bare.

Legs black, tibiae with an obscure reddish tinge; fore tarsi slender; mid tibia bearing two strong bristles on outer front side near middle; hind tibia subciliate; claws and pulvilli shorter than last tarsal segment.

Wings subhyaline; veins brown, second with two or three hairs near base, others bare; first posterior cell narrowly open, ending well before wing tip; bend of fourth vein evenly rounded, without stump or fold; hind cross vein joining fourth nearer bend than small cross vein; last section of fifth vein barely one-third length of preceding; costal spine small; epaulets blackish; calypters opaque white.

Abdomen short and rather thick in profile, apex obtusely pointed, wholly black; intermediate segments with thin changeable gray pollen above extending almost to hind margin in some views, fourth more heavily pollinose except on apex; basal segments each with one pair of median marginals, third with marginal row of strong bristles; fourth with a marginal and discal row besides numerous scattered smaller bristles above; discals on intermediate segments nearly always irregular and at times small or lacking on one or both segments; anal orifice slitlike, genitalia retracted, not adapted for piercing; sternites covered.

**Male.**—Front at vertex 0.25 of head width (one specimen); equibroad to middle thence diverging downward in facial angle; no orbitals; third anten-



nal segment just under twice length of second; hind tibiae ciliate, claws and pulvilli elongate; abdomen broadly reddish on sides, intermediate segments more thickly pollinose and hairs on upper surface erect, discals barely differentiated; genitalia small, retracted, lobes of fifth sternite exposed and moderately prominent.

Length, 6-8 mm.

Holotype: Female, College Station, Texas, June 23, 1944 (H. J. Reinhard). Allotype: Male, same data as type, except dated October 13, 1917. Paratypes: 35 females, College Station, Texas, May, June and October, 1917-46 (H. J. Reinhard) and 1 female, Jefferson City, Missouri, June 21, 1924 (C. F. Adams) in Dr. Adams' collection.

*Euceromasia solata*, n. sp.

**Male and female.**—Very similar to the preceding species but at once distinguished by the red legs and abdomen. Thorax black, gray pollinose, scutellum usually reddish on apex. Second antennal segment rather long, yellow, third wholly black, usually less than twice length of second; palpi and labella pale reddish. Abdomen at times infuscated at middle above including anal segment; anal orifice closed slitlike; male genitalia small, forceps short, divided apically, moderately wide in profile with a prominent ridge or keel on basal half; accessory process as long as forceps, rounded at tip; fifth sternite broadly and deeply incised, lobes prominent, beset with several long bristly hairs on inner margin; female genitalia subventral, retracted, not adapted for piercing.

Length, 6.5-8 mm.

Holotype: Male, College Station, Texas, May 2, 1944 (H. J. Reinhard). Allotype: Female, same data as type but dated June 27, 1944. Paratypes: 2 males and 2 females, all College Station, Texas, April-May, 1938 and 1944 (H. J. Reinhard).

## A NEW MAPLE APHID FROM UTAH AND SOME APHID RECORDS

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The following report includes the description of an apparently undescribed aphid of the genus *Periphyllus*, which was collected while noticeably abundant on soft maple foliage at Centerville, Utah. The writer is indebted to Professor M. A. Palmer and to Dr. P. W. Mason for their opinions concerning this aphid. Collection records also are given for a number of other species of aphids.

*Periphyllus palmerae* n. sp.

**Alate vivipara.**—Body 1.35 to 1.52 mm. long; color largely black to blackish, with dark bands crossing dorsum of abdomen; body and appendages armed with long hairs which on vertex reach .16 to .205 mm. long, .19 to .24 on abdomen, up to .126 to .142 on antennal III, and some being .2 to .25 mm. long on hind tibiae; antennal III, .537 to .72 mm. long with 10 to 19 wide

rimmed sensoria (usually 11 to 15); IV, .33 to .42; V, .265 to .36; VI, .11 to .12 plus about .36 to .38 mm. (unguis shriveled on specimens at hand); rostral IV + V slenderly obtuse, .126 mm. long; wings with media twice branched; hind tibiae 1.21 to 1.55; hind tarsi .16 to .172; blackish cornicles .19 to .237 mm. long, paler toward irregular, poorly developed flange, with distal 66 to 80 per cent of length reticulated; cauda and anal plate rounded.

**Alate male.**—Body 1.36 mm. long, blackish, body hairs usually shorter than in apterous vivipara, but with hairs on leg reaching .18 to .221 mm.; antennal III, .64 to .68 studded with 75 to 97 sensoria; IV, .45 to .49 with 35 to 53 sensoria; V, .39 to .4 with 13 to 17 sensoria; VI, .14 plus about .44 to .48; rostral IV + V .125, scarcely reaching third coxae; cornicles .142 mm. long.

**Collections.**—Abundant on soft maple at Centerville, Utah, October 10, 1941, G. F. Knowlton, collector. Type in the collection of the writer. Paratypes in the U.S. National Museum and Colorado A. and M. College.

**Taxonomy.**—*Periphyllus palmerae* n. sp. resembles *Periphyllus americanus* (Baker), from which it differs in being smaller in size, having slightly shorter antennae, cornicles, rostral IV + V, averaging fewer sensoria on antennal III, and having a distinctly different general appearance when alive. The front wings of *P. palmerae* show less pigmentation in stigma and large trunk leading to stigma.

### Other Records

*Periphyllus americanus* (Baker) on sycamore maple, *Acer pseudoplatinus*, Logan, October 3, 1941 and June 1942, and Salt Lake City, October 10, 1941; *Acer* in Settlement Canyon, Tooele County, June 18, 1943; *Acer sacharinum*, Centerville, May 23, 1940; Provo Canyon, July 26, 1945, in Utah. Also on maple foliage at Worland, Wyoming, September 12, 1941 (Knowlton).

*P. negundinis* (Thomas) on *Acer negundo*, Logan, June 1, 1942; Mona, Spanish Fork, Clarkston, Salt Lake City, Farmington, Delta, Brigham City, Ft. Duchesne, Leeds, Kanosh and St. George, in Utah. Also collected at Twin Falls and Franklin, Idaho; Flagstaff, Arizona; and Jackson, Wyoming (Knowlton).

*P. populicola* (Thomas) collected in Utah on (*Populus angustifolia*, *P. balsamifera* and *P. occidentalis*. Localities include Summit Valley of Logan Canyon, Big Cottonwood Canyon, Roy, Holmes Creek in Rich County, Duck Creek Spring in Kane County, Duchesne, Brigham City and Plain City, in Utah. Also collected by the writer in Wyoming, Montana, Idaho, Arizona, Minnesota, Wisconsin and Nevada.

*P. populicola* var *bruneri* (Williams), usually on *Populus tremuloides*, at Mt. Timpanogos, Logan Canyon, Trout Creek, American Fork Canyon, Soldier Creek, and Spanish Fork Canyon, in Utah. Also collected at Mesa, Arizona, May 12, 1945; and Emigration Canyon, Idaho, June 24, 1925.

*P. salicinigra* K. at Manassa, Colorado, May 22, 1943 (A. B. Haws).

*Aphis bonnevillensis* K. Buchanan, Oregon, August 25, 1944.

*A. debilicornis* (G.-P.) accidental on potato, Clarkston, Utah, July 3, 1946 (Det. P. W. Mason).

**A. eriophori** Wlk. accidentals on hollyhock, beneath badly curled snow-ball bush, Ogden, Utah, May 7, 1946 (Det. M. A. Palmer).

**A. gregalis** K. on *Chrysothamnus nauseosus*, Indian Massacre Rocks, Idaho, August 21, 1938.

**A. hederæ** Kalt. damaging English ivy, Logan, Utah, June 5, 1946 (Det. M. A. Palmer).

**A. heraclella** Davis, damaging celery during June and August of 1946 at American Fork, Utah; aphid transmitted western celery mosaic was very destructive in Utah during 1946; damaging celery at Deweyville and Brigham, Utah, August 5, 1943 (Knowlton, D. R. Maddock and P. E. Telford).

**A. kachena** Hottes on indian paintbrush, Toquerville and Hurricane, Utah, July 4, 1946.

**A. ribi-gillettei** K.-A. damaging apical leaves of black currant at Kaysville, Utah, June 21, 1941; Salt Lake, July 27, 1945.

**Capitophorous gillettei** Theob. on *Polygonum*, Morgan, Utah, June 30, 1925; and Puyallup, Washington, August 23, 1937 (H. C. Bennion).

**C. longinectarius** G.-P. on *Artemisia* at Mt. Timpanogos, Utah, July 26, 1945; and Teton Pass, Wyoming, July 20, 1946.

**C. magnautensis** K.-S. on *Chrysothamnus viscidiflorus* subsp. *linifolius* at Huntington, Utah, July 27, 1935.

**C. oestlundii** K. on *Chrysothamnus nauseosus* at Elko, Nevada, June 6, 1934; Afton, Wyoming, July 20, 1946; Vale, Oregon, August 25, 1945; Emmett, Idaho, August 25, 1945.

**C. utensus** P.-K. on *Chrysothamnus viscidiflorus* var. *stenophyllus*, 10 miles west of Snowville, Utah, June 7, 1930; Dayton, Idaho, June 21, 1934.

**C. wasatchii** K. on *Chrysothamnus nauseosus*, Mt. Timpanogos, Utah, July 26, 1945.

**C. xanthii** (Oest.) on cocklebur, Hurricane, Utah, July 4, 1946; and Overton, Nevada, August 29, 1946.

**C. zoomontanus** K.-S. on *Artemisia tridentata*, Wolf Creek Canyon, Utah, July 24, 1945.

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## ARTEMISAPHIS ARTEMISICOLA (Williams)

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**Aphis artemisicola** Williams (1910, p. 37), Aphididae of Nebraska) has been something of a puzzle to the writers. In length of antennae, occurrence of semi-distinct reticulations on ends of cornicles, and in possessing moderately developed antennal tubercles in alate form, this species is related to the genus *Macrosiphum* Pass. In body size and shape, the length of cornicles, vertex shape in aptera, pointed antennal hairs and shape of cauda it is closely related to *Aphis* L. In general, the vertex, hairs and reticulations on cornicles resemble *Mucrotrichaphis* K.-A. The somewhat gibbous first antennal joint suggest *Myzus* Pass. The median downward-pointed protuberance on the ventral side of the anal plate is suggestive of *Bipersona* Hottes.

**Artemisaphis n. gen.**

Moderate sized aphids; antennal tubercles scarcely exceeding vertex in aptera, definitely exceeding vertex in alates; first antennal segment thickened, somewhat gibbous on inner surface; cornicles of medium length, imbricated, with a few rows at distal end indistinctly reticulated; anal plate with ventral wartlike protruberence pointing chiefly downward.

Type, *Aphis artemisicola* Williams.

**Artemisaphis artemisicola (Williams)**

Collected on *Artemisia vulgaris* at Pleasant Grove, Utah, July 6, 1939 (G. F. Knowlton). Taken from *Artemisia tridentata* at Snowville, July 3, 1928; Blue Creek, July 3, 1928; Echo Canyon, June 17, 1925; Bear River City, July 3, 1928; Logan Canyon, May 26, 1928; Wasatch, June 17, 1925; Laketown, August 25, 1938; Paradise, August 23, 1938; Monte Cristo, August 9, 1938; Garden City, August 25, 1938, in Utah (by G. F. Knowlton). Collected at Woodruff, Utah, August 28, 1938 (Knowlton-D. E. Hardy). Also collected on *Artemisia tridentata* at Eagle, August 20, 1938; Marsh Valley, August 18, 1938; and Eden, August 21, 1938, in Idaho (G. F. Knowlton); at Bozeman, Montana, August 20, 1926 (C. B. Philip); Gibson and Ryegate, Montana, August 14, 1942 (H. F. Thornley); at Evanston, June 17, 1925, and Jackson, Wyoming, August 5, 1927 (G. F. Knowlton; and Elko, Nevada, July 1, 1939 (G. F. Knowlton).

## THE NORTH AMERICAN SPECIES OF STILICOLINA CASEY (COLEOPTERA, STAPHYLINIDAE)

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The genus *Stilicolina* was described by Casey (1905, p. 228) to receive *tristis* Melshimer (1846, p. 40) originally described in *Stilicus*. Blackwelder (1939, p. 106) synonymized *Omostilica* Casey (1905, p. 229), containing *sonorina* Casey, with *Stilicolina*, and listed *tristis* and *sonorina* as the known representatives of the genus. The discovery of an undescribed species from Arizona in the collection of Cornell University has led to the restudy of available material in the genus.

*Stilicolina* belongs to the subfamily Paederinae, and may be recognized by the carinate prosternum, partially united gular sutures, dense ground sculpture of the head, 4 or 6 toothed labrum, the very narrow neck, and the mandibular dentition, the left mandible having three teeth and the right four teeth.

The male genitalia offer satisfactory characters for distinguishing the species but the female genitalia are of little value in two species in which they were studied.

**Key to North American Species (Males)**

1. Median lobe of male genitalia acute at apex and angled on sides;  
lateral lobe with two small marginal teeth (figs. A and B.); head

- wider than elytra; gular sutures united from middle of head to base ..... *sonorina*
- Median lobe of male genitalia evenly rounded at apex and nearly straight on sides; lateral lobe without marginal teeth; head narrower than elytra; gular sutures united for two-thirds their length to base of head.....2
2. Eighth sternite without setae in posterior one-fourth except below emargination, and with emargination about as deep as wide (fig. E); median lobe of genitalia strongly curved before apex on lower side (figs. C and D) .... *tristis*
- Eighth sternite with setae reaching posterior margin, and with emargination about twice as wide as deep (fig. H); median lobe of genitalia nearly straight to apex on lower side (figs. F and G) ..... *fasta*

### *Stilicolina sonorina* (Casey)

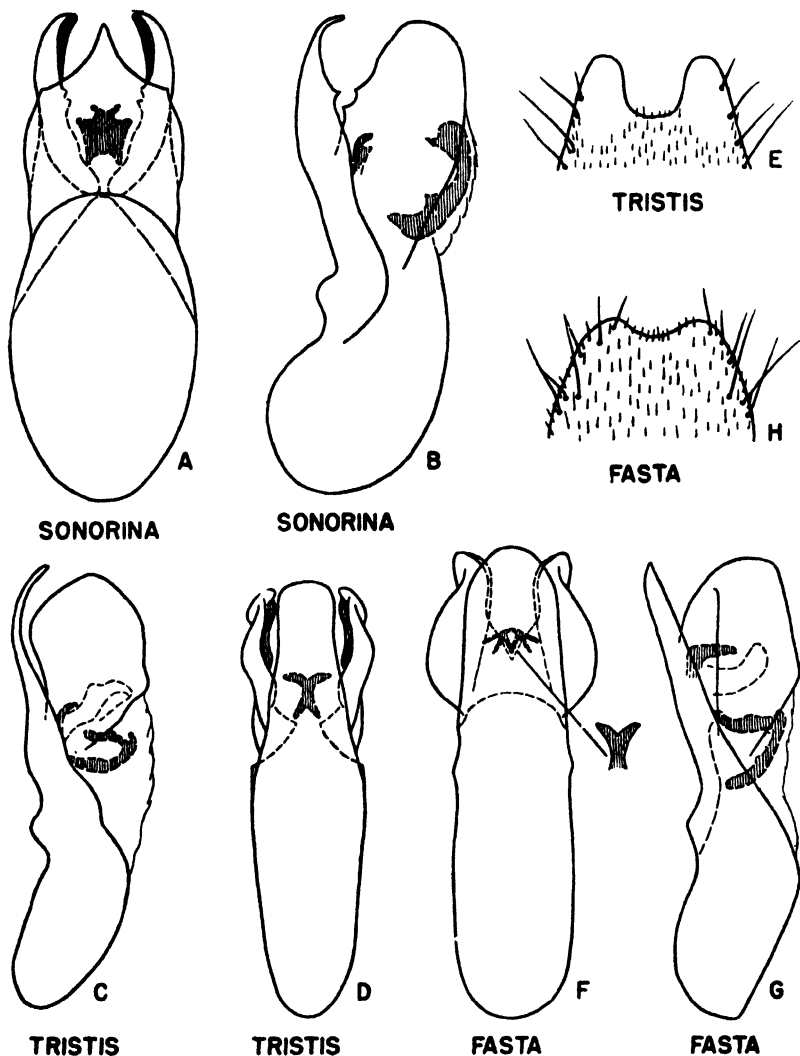
In addition to the characters mentioned in the key, this species also differs from *tristis* and *fasta* by having four instead of six labral teeth, and the eye is also smaller measuring about six times its length from neck. It is a larger and more robust species, and the prosternal carina does not quite reach the middle of the prosternum in front of the anterior coxae. Additional differences are shown in the figures of the genitalia (Figs. A and B). The species was described from Arizona, and an additional male labeled "Ariz." has been examined in the collection of Cornell University. The female is unknown.

### *Stilicolina tristis* (Melsh.)

The eye in this species and *fasta* is larger than in *sonorina* and is about four times its length from the neck. The prosternal carina extends to the anterior margin of the prosternum and is very sharp. Except for the differences noted in the key and those shown in the illustrations, *tristis* and *fasta* are extremely similar. The female genitalia of the two species are similar and no important differences were noted. On account of the similarity of these two species, it is possible that the Arizona record by LeConte (1880, p. 178) under *Stiliculus tristis* may refer to *fasta*. This species was described from Pennsylvania, and additional records have been noted for Ohio and the District of Columbia. I have studied a pair each from Washington County, Arkansas, April 13, 1941, M. W. Sanderson, in moss on shelf of rocky bluff; and Clemson, South Carolina, March 30, 1944, O. L. Cartwright, in flood debris.

### *Stilicolina fasta* n. sp.

**Male.**—Length 5 mm. Color reddish brown and similar in appearance to *tristis* (Melsh.) except for differences in the 8th sternite and genitalia of the male. Eighth sternite evenly clothed with setae to the posterior margin; emargination shallow, more than twice as wide as deep (Fig. H). Genitalia as in Figs. F and G. Median lobe about twice as long as wide, when measured from the base of lateral lobe, parallel sided and evenly rounded at apex. Lower margin of lobe nearly straight to apex. Lateral lobe broadly



### Explanation of Figures

- A. *Stilicolina sonorina* (Csy.). Male genitalia, ventral view.  
 B. *Stilicolina sonorina* (Csy.). Male genitalia, lateral view.  
 C. *Stilicolina tristis* (Melsh.). Male genitalia, ventral view.  
 D. *Stilicolina tristis* (Melsh.). Male genitalia, lateral view.  
 E. *Stilicolina tristis* (Melsh.). Eighth abdominal sternite of male.  
 F. *Stilicolina fasta* n. sp. Male genitalia, ventral view.  
 G. *Stilicolina fasta* n. sp. Male genitalia, lateral view.  
 H. *Stilicolina fasta* n. sp. Eighth abdominal sternite of male.

rounded on sides to form a keel like shelf; lower margin nearly straight toward apex; the two lobes joined at base below median lobe to form a broad somewhat V-shaped emargination. Internal structures on aedeagus as in illustrations.

**Female.**—Similar to male except for a rounded 8th abdominal sternite. Satisfactory characters for distinguishing the females of this species and *tristis* have not been found, although *tristis* appears to be a deeper brown in color. The shape, sculpture and genitalia are very similar.

**Holotype, male.**—Huachuca Mountains, Arizona, July.

**Allotype, female.**—Same data.

Types deposited in the collection of Cornell University.

This species is satisfactorily distinguished from *tristis* only by the differences in the eighth sternite and the genitalia of the males.

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## SOME NOTES ON THE GENUS *PENTAGRAMMA* AND FOUR NEW SPECIES\*

(Homoptera-Delphacidae-Asiracinae)

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In 1897 the genus *Pentagramma* was erected by E. P. VanDuzee for a North American species, *Liburnia vittatifrons* Uhler. Crawford, in 1914, added two new species, *P. minore* from Wyoming and *P. bivittata* from Nicaragua. Muir's description of a new species from Argentina, *P. nigrifrons*, was published in 1934.

**Description of the genus:** Head and pronotum about the same width; vertex surpassing eyes, longer than pronotum, tricarinate, lateral carinae following caudo-mesal margins of eyes, becoming obsolete before reaching pronotal margin; scutellum 5-carinate; caudal margins of eyes protruding beyond cephalo-lateral margins of pronotum; frons longer than broad, with two median carinae; antennae terete or subterete, second segment longer than first; genae large; legs large, slender, femora and tibiae sometimes flattened, proximal segment of hind tarsi longer than the rest of tarsus; hind tibiae usually armed with three lateral spines; calcar spiniform.

The genus occurs in the Western Hemisphere from Canada to Argentina. Its habitat is salt and other marsh land, and specimens are commonly collected on sedge, rush, and marsh grass.

The main characters on which the species have been separated are the structure and color of the frons, vertex, pronotum, and scutellum, the rela-

\*Contribution from the Department of Entomology, University of Kansas, and the Division of Entomology, University Farm, St. Paul, Minnesota.

tive length and color of the antennal segments, the structure, and color of the anterior tibiae and the male genital characters. The frons is usually variable in color in the different species. The position of the median carinae is distinctive. The anterior tibiae serve to separate the species into two groups, those with but a very slightly flattened condition, and those with a conspicuously flattened arrangement. The presence or absence of a dark brown spot on the distal margin of the anterior tibiae is also of comparative importance. In color and relative length, the antennal segments show distinctive characters. The 11th tergite is long in both sexes and its relative length with respect to the 9th and 10th tergites is valuable as a character. The distal margin of the 9th abdominal tergite may or may not be emarginate and this character is utilized in separating the species. The genital styles of the male vary in length and shape and are distinctive, though they are secondary characters in determining the species. The length of the forewings is of some specific value, but wing venation is unreliable.

Four species, *P. longistylata*, *P. cosquina*, *P. douglasensis* and *P. variegata*, are here described as new to science. *P. minore* Crawford is a synonym of *P. vittatifrons* (Uhler), and *Lepticus oculatus* Crawford a synonym of *P. bivittata* Crawford.

#### Key to Species of *Pentagramma*

1. Anterior tibiae conspicuously flattened, dark brown transverse band near their distal margin ..... 2  
Anterior tibiae slender, or but slightly flattened, with but a small, or no, distal brown band ..... 4
2. 11th tergite short, about as long as 9th ..... 3  
11th tergite at least as long as 9th and 10th combined, inner margins of genital styles uneven ..... *longistylata*, sp. nov.
3. Forewings extend beyond distal margin of 11th tergite; second segment of antennae slightly more than twice the length of first ..... *bivittata* Crawford  
Forewings rarely extending to caudal margin of 9th tergite; second segment of antennae three times the length of first ..... *vittatifrons* (Uhler)
4. Frons black, with white markings ..... *nigrifrons* Muir  
Frons variable, with green and yellow or orange markings ..... 5
5. Legs marked with brown longitudinal vittae; no transverse brown band present near distal margin of anterior tibiae; carinae of pronotum and scutellum distinct ..... 6  
Legs not marked with brown longitudinal vittae; small brown band present near distal margin of anterior tibiae; carinae of pronotum and scutellum usually obsolete ..... *cosquina*, sp. nov.
6. Pronotum cephalad of lateral carinae dark brown; large dull green species, 7-10 mm. .... *douglasensis*, sp. nov.  
Pronotum cephalad of lateral carinae light brown or yellow; yellowish green species, 6.5-8.8 mm. .... *variegata*, sp. nov.



### 1. *Pentagramma longistylata* sp. nov.

This species resembles *P. vittatifrons* (Uhler) but is somewhat larger, has 11th tergite as long as 9th and 10th combined and has acute genital styles with uneven inner margins.

**Length:** Male, cephalic margin of vertex to distal margin of 11th tergite, 8 mm., forewings, 4.7 mm.; female, 8 mm., forewings, 5.3 mm.

**Color:** Vertex, pronotum, tegulae, and abdominal tergites fulvous, with faint greenish-yellow markings; frons marked with two very distinct crescentic orange bands; clypeus fuscous, darker at caudal margin; eyes banded with light and purplish-brown; antennae light brown, with two longitudinal dark brown bands fusing at distal margin of first antennal segment; venter fulvous; genital styles brown; 11th tergite fulvous; transverse brown band present on distal margin of anterior tibiae.

**Structure:** Cephalic margin of vertex rounded, slightly longer than broad, caudal margin truncate; pronotum slightly wider than head, dorso-lateral margins narrow; scutellum slightly broader than pronotum, inner pair of carinae not evenly curved near mid-line of scutellum; cephalic margin of frons rounded, not truncate; length of anterior femora about eight times the width; anterior tibiae conspicuously flattened; hind tibiae with three spines; calcar simple; anal style very long, as long as combined lengths of 9th and 10th tergites; forewings not reaching beyond 10th tergite; genital styles acute at distal margins, inner margins uneven.

**Female:** Similar to male in color and structure, somewhat larger.

**Holotype** ♂, allotype ♀ 15 ♂ and 14 ♀ paratypes, Jackson Co., Texas, August 9, 1928, R. H. Beamer; other paratypes, 2 ♂♂ and 1 ♀, Bee Co., Texas, July 25, 1928, R. H. Beamer; 3 ♂♂ and 1 ♀, Corpus Christi, Texas, November 18, 1932, L. D. Tuthill; 8 ♂♂ and 6 ♀♀, Victoria Co., Texas, August 9, 1928, R. H. Beamer; 6 ♂♂ Garcitas Creek, Victoria, Texas, November 8, 1932, L. D. Tuthill; 1 ♀, Victoria, Texas, July 27, J. D. Mitchell, Hunter No. 1748; 1 ♂, Galveston, Texas, May, F. H. Snow; 1 ♀ Gainesville, Florida, May 21, 1915. Types and paratypes in Snow Entomological Collections. Other paratypes in the University of Minnesota Collection.

### 2. *Pentagramma bivittata* Crawford

*Pentagramma bivittata* Crawford, David L., Proc. U.S. Nat. Mus., 46:566, 1914.  
*Lepticus oculatus* Crawford, David L., Proc. U.S. Nat. Mus., 46:567, 1914.

Described from 7 ♂♂ and 18 ♀♀ from Managua, Nicaragua, collected by Baker. Type in Pomona College Collection, Claremont, California. One female studied from Lake Lomalta, Texas, November 27, 1910, has been identified as this species. Types have not been available for study, but Crawford's figures and description indicate a distinct species. He separated it from *P. vittatifrons* (Uhler) on the basis of head width, relative lengths of antennal segments, the banding of the frons and geographical distribution. The forewings extend beyond the distal margin of the 11th tergite which is short. The anterior tibiae are flattened and marked near the distal margin with a large transverse brown band.

Dozier collected 14 nymphs of several instars sweeping bulrushes and sedges in a swampy field near Sandusky, Ohio, October 6, 1921, and found they

agreed with Crawford's description of *Lepticus oculatus*. He also had three specimens in the last instar taken by Professor Osborn at Delphos, Kansas, with numbers of *P. vittatifrons* (Uhler), confirming his suspicion that *L. oculatus* Crawford is an immature *Pentagramma*. It is the author's opinion that immature specimens of *P. vittatifrons* (Uhler) and *P. bivittata* Crawford would fit Crawford's description of *Lepticus oculatus* and that the specimens Dozier studied were really *P. vittatifrons* (Uhler). The writer therefore believes *L. oculatus* Crawford, described from a male nymph of a late instar, from Managua, Nicaragua, to be *P. bivittata* Crawford.

### 3. *Pentagramma vittatifrons* (Uhler)

*Liburnia vittatifrons* Uhler, P. R., U.S. Geol. & Geog. Survey, 1:352, 1876

*Pentagramma minore* Crawford, David L., Proc. U.S. Nat. Mus., 46:567, 1914

This is the most common species in the genus. It is the smallest species having short forewings. It is related to *P. longistylata* sp. nov., but the 11th tergite is about as long as the 9th, the styles are smooth on the inner margin and the first segment of the antennae is less than one third the length of the second.

**Length:** Male, cephalic margin of vertex to distal margin of 11th tergite. 5.0 mm., forewings 3.8 mm.; female, 7.0 mm., forewings 5.0 mm.

**Color:** Vertex, pronotum, scutellum, and tegulae greenish-yellow; eyes dark brown; forewings sub-hyaline, yellowish, abdominal tergites yellowish, with greenish-yellow markings; carinae light yellow; frons greenish-yellow, marked with two indefinite large orange bands; clypeus brownish, caudal margin dark brown; caudal margins of genae marked with prominent dark brown spot between antennae and frons, otherwise light yellow; antennae light yellow, marked with two longitudinal brown bands, a transverse brown band joining the longitudinal bands at distal margin of first antennal segment; lateral margins of pronotum, meso- and meta-pleurae light yellow with fuscous markings; venter greenish-yellow with fuscous markings; coxae greenish-yellow, anterior coxae marked with a large brown spot on inner disc; femora marked with three distinct and one indistinct brown longitudinal bands; anterior tibiae with dark brown band near distal margin; extending to both sides of its flattened surface; middle and posterior tibiae yellow with two brown longitudinal bands.

**Structure:** Vertex somewhat longer than broad, median carinae almost obsolete near cephalic margin; scutellar carinae distinct; pronotum almost half as long as scutellum, caudal margin nearly truncate; scutellum about the length of vertex; forewings extend to 9th tergite; veins very slightly setigerous; pronotum slightly broader than head; frons almost same width at caudal and cephalic margins, almost as broad as long, nearly circular, cephalic margin more truncate, the two median carinae widely separated, making the median cell so formed twice the width of the lateral cells of the frons; first segment of antennae very short, less than one-third the length of second; anterior femora about seven times as long as broad; anterior tibiae conspicuously flattened; hind tibiae marked with three short spines; calcar normal; 11th tergite about the length of 9th tergite; genital styles acute, inner margins even, enclosing a nearly circular area from ventral view. Forewings do not extend beyond 10th tergite.

**Female**, larger but similar in color and structure to male.

**Lectotype** ♂, New Jersey, August, P. R. Uhler, in Collection of U.S. National Museum here designated. More than 300 specimens have been studied from the following states: Colorado, Idaho, Illinois, Iowa, Kansas, Maryland, Montana, Nebraska, New Jersey, New Mexico, New York, North Dakota, South Dakota, Utah, Virginia, Washington, Wyoming.

There is considerable variation in color, which is usually constant for the locality. Specimens vary from very green to brown or fuscous coloration. The pygofer in the male may be marked with a fuscous brown spot of varying size. The abdomen is often swollen and the conjunctivae between the segments gives the abdomen a white appearance. Weathered specimens may be fulvous to brown. The length of the males may vary from 4.5 mm. to 6 mm.; the female 6 to 8.5 mm. The forewing length of the male varies from 3.5 to 4 mm.; the female, 4.8 to 5.2 mm.

Uhler did not designate type specimens. In notes following his description he writes, "inhabits Dacota, collected by Mr. Rothauer; Illinois. Robert Kennicott. It may occur abundantly upon salt marshes of the sea coasts of Maryland and New Jersey, living among the long stiff grass." These specimens he writes of, have been studied. One, a male, is labelled *Liburnia vittatifrons* Uhler, and Dr. P. W. Oman, Homopterist, U.S. National Museum, has confirmed the handwriting as Uhler's. The male is designated a lectotype on this basis. *Pentagramma minore* Crawford is a synonym of this species. A male from Socorro Co., New Mexico, agreed with the type of *P. minore* Crawford when compared by Dr. Oman. The types of *P. minore* Crawford, 1 male from Sheridan and 1 female from Banner, Wyoming, C. W. Metz, are in the Pomona College Collection.

#### 4. *Pentagramma nigrifrons* Muir

*Pentagramma nigrifrons* Muir, *Annals & Mag. Nat. Hist.*, 14: 575, 1934

The very black frons with white markings serves to separate this from all other known species.

**Length:** Male, cephalic margin of vertex to distal margin of forewing, 6 mm., forewing, 5 mm.

**Color.** Cephalic margin of vertex very dark brown, including cephalic portion of the two anterior cells; vertex and pronotum otherwise cream yellow, with light central orange markings; tegulae cream yellow, except for cephalic margin, brown; scutellum orange, except for dirty cream yellow coloration along mid-line and cephalic dark brown areas; latero-mesal margins of scutellum marked with dark brown spot; forewings sub-hyaline, veins ivory; carinae light yellow, indistinct; abdominal tergites fuscous; 11th tergite light brown, frons black, except for white band at cephalic margin, and a lateral mesal white spot on each side of frons; cypeus black, except for cephalic margin, light brown; genae dark brown, cephalic margin white; dark band between antennae and frons unbroken except for white spot on caudo-mesal margins of genae; antennae marked with two longitudinal black bands, fusing at proximal margin of first segment; lateral margins of pronotum cream yellow, devoid of brown markings; meso- and meta-pleurae cream yellow, except for

dark brown markings in central region; venter fuscous, almost brick red; coxae fuscous; trochanters yellow; anterior femora with three distinct longitudinal brown stripes and one more or less broken band; anterior tibiae with small dark brown spot near distal margin and two brown longitudinal stripes, becoming obsolete before reaching distal margin; middle and hind femora with very indistinct brown longitudinal stripes, otherwise pale yellow.

**Structure:** Length of vertex almost twice its width, median carinae obsolete at caudal and cephalic margins; carinae of pronotum distinct; scutellar carinae obsolete; scutellum almost twice the length of pronotum; frons longer than broad, carinae obsolete at caudal margin, somewhat indistinct at cephalic margin; second antennal segment about twice the length of first; forewings extend beyond distal margin of 11th tergite; anterior femora about seven times as long as wide; anterior tibiae but slightly flattened; 11th tergite about as long as 10th; distal margins of genital styles acute; ventral margin of 10th abdominal tergite not deeply emarginate.

Holotype ♀, Argentina, H. Wilkenson, in British Museum; allotype ♂ here designated, Pirapora, Minas, Geraea, Brazil, November 11-13, 1919, Cornell University Expedition, in Cornell University Collection.

#### 5. *Pentagramma cosquina* sp. nov.

Related to *P. nigrifrons* Muir, but smaller with dull green frons with orange markings.

**Length:** Female, cephalic margin of vertex to distal margin of forewing, 7.4 mm., forewing, 6 mm.

**Color:** Vertex fulvous; cephalic margin of pronotum fulvous, distal half pale green, carinae pale green; scutellum white, orange, and yellow, with lateral margins white; forewings hyaline, veins light; abdominal tergites fuscous with dark brown markings; eyes dark brown; frons dull green with indistinct orange markings; a single transverse narrow light band on frons, carinae light green; clypeus dull green; genae pale green except for small fuscous spot between antennae and frons; antennae green, with two indistinct brown longitudinal bands on second antennal segment; lateral margins of pronotum pale green; meso- and meta-pleurae pale yellow; legs light green, with no longitudinal stripes; anterior coxae with small dark brown spot on inner disc; anterior tibiae with small dark brown transverse band near distal margin; abdominal sternites yellow; cephalic portion of ovipositor light fuscous.

**Structure:** Vertex slightly longer than broad, considerably longer than pronotum; pronotal carinae indistinct, obsolete at margins; scutellum almost as long as head and pronotum combined, carinae nearly obsolete; antennae longer than in any other known species; second segment three times the length of first; sensory organs on second segment distinct and arranged in definite rows; median carinae of frons obsolete near caudal margin, widely separated through middle; clypeus small, nearly truncate at caudal margin; femora and tibiae slightly flattened, tibiae somewhat rectangular in cross section; proximal segment of anterior tarsi very small; of hind tarsi large, about four times its width; anterior femora about seven times their width; 11th tergite slightly longer than 10th; forewings extend beyond tip of abdomen.

**Holotype** ♀, Cosquin, Sierra de Cordoba, Argentina, March 1-9, 1920, Cornell University Expedition, in Cornell University Collection.

**6. *Pentagramma douglasensis* sp. nov.**

Resembles *P. vittatifrons* (Uhler) but larger (10 mm.); anterior tibia not flattened and with a deep emargination on the distal margin of the 9th tergite.

**Length:** Male, cephalic margin of vertex to distal margin of forewings, 7.4 mm., forewings, 6.3 mm.; female 10 mm., forewing, 7 mm.

**Color:** Dorsum mostly dull green; pronotum cephalad of lateral carinae dark brown; cephalic margin of scutellum and tegulae dark brown, latero-distal margin of scutellum brown; distal half of forewings brown, cephalic portion of forewings sub-hyaline, veins light brown; eyes dark fuscous; abdominal tergites dark brown with few yellow markings; frons dull yellowish-green, with two indistinct orange transverse bands; distal half of clypeus very dark brown, cephalic portion pale greenish-yellow; caudal margin of genae between antennae and frons marked with dark brown band, another brown spot cephalad of the brown band almost reaching to lateral margin of frons; antennae light brown except for two dark brown longitudinal stripes on second segment, and a double dark brown stripe appearing fused on the first; lateral margins of pronotum marked with a dark brown stripe; meso- and metapleurae greenish-yellow, marked with a dark brown stripe; venter dark brown, distal margins of abdominal sternites a lighter brown; coxae light fuscous, anterior coxae marked with a large brown spot on inner disc; femora marked with four dark brown longitudinal stripes, fused at proximal and distal margins on hind femora; tibiae marked with two dark brown longitudinal stripes.

**Structure:** Vertex considerably longer than broad; pronotum large, about two-thirds the length of vertex; scutellum about as long as broad, carinae prominent; carinae distinct at cephalic margin of vertex, parallel, meeting median carinae of frons; forewings very slightly setigerous, extending beyond 11th tergite; first antennal segment more than half the length of the second; anterior femur eight times as long as wide; anterior tibiae not distinctly flattened, length about ten times their width, somewhat rectangular in cross section; length of middle femora about six times their width; middle tibiae narrow, length about six times their width; posterior tibiae narrow, length about five times width; distal half of hind tibiae expand before reaching distal margin; three distinct spines on hind tibiae; spiniform calcar simple; proximal tarsal segment of hind leg about five times width, expanded distally; second tarsal segment of hind leg about twice width; 11th tergite short, about the length of 10th; 9th tergite with an emargination on distal dorso-lateral margin.

**Female:** Forewings extend to tip of 11th tergite; ovipositor light brown, surrounded with dark brown markings; general color dull green, venter broad, dark.

**Holotype** ♂, allotype ♀, Cheboygan Co., Michigan, August 4, 1933, H. B. Hungerford; paratypes same place and collector; 2 ♂♂ and 2 ♀♀, June 30, 1932; 2 ♂♂, July 2, 1927; 1 ♀ July 3, 1924; 1 ♀ July 3, 1923; 1 ♀, Burt Lake, July 14, 1930; 1 ♂ sedge pool, July 17, 1923; 3 ♀♀, July 27, 1927; 1 ♂ and 3 ♀♀,

Bessey Creek, July 29, 1925; 1 ♀, July 30, 1927; 2 ♂♂ and 8 ♀♀, Aug. 4, 1933. Other paratypes from Cheboygan Co., Michigan: 1 ♀ June 29, 1933, B. Miner; 1 ♀ Douglas Lake, July 11, 1927, C. A.; 5 ♂♂ and 1 ♀, Douglas Lake, July 23, 1926, Charles Martin; 1 ♀ Douglas Lake, July 29, 1927, E. M. Becton. Types in the Snow Entomological Collections.

#### 7. *Pentagramma variegata* sp. nov.

Resembles *P. douglasensis* but pronotum cephalad of lateral carinae light brown or yellow, and smaller (6.5-8.8 mm.), with general color yellowish green.

**Length:** Male, cephalic margin of vertex to distal margin of forewing, 6.8, forewing, 5.6 mm.; female, 8.2 mm., forewing, 6.4 mm.

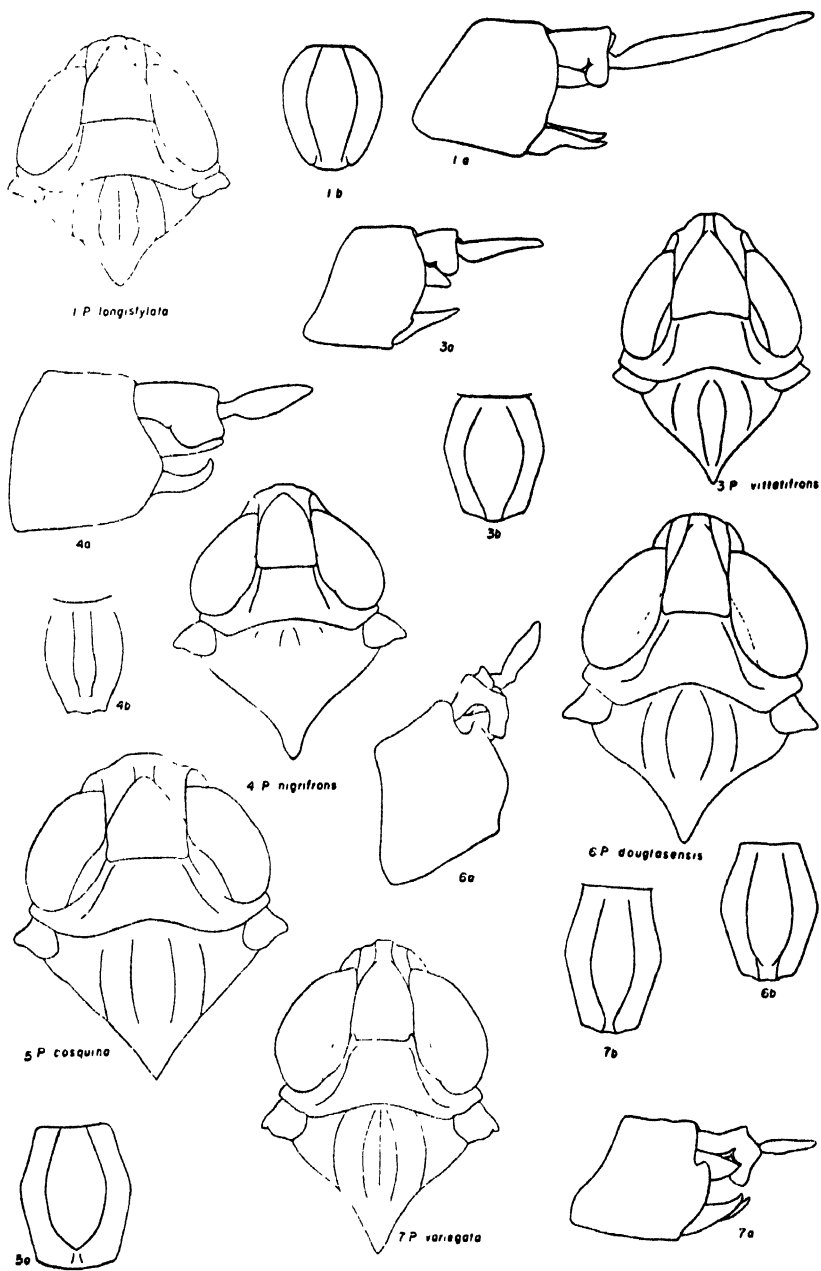
**Color:** Green, with orange, light fuscous and fulvous markings on vertex, pronotum, and scutellum; carinae light green; yellow-green markings present on cephalic margin of pronotum, extreme lateral margin of pronotum with small dark brown band; forewings sub-hyaline, distal half light brown, veins brown; abdominal tergites brown with pale yellow markings; frons green, with two indistinct transverse orange bands which more or less fuse in middle; caudal half of clypeus brown, cephalic portion fulvous; genae with dark brown spot between antennae and frons; antennae with two distinct longitudinal brown stripes, fusing at distal margin of first segment; venter brown; pygofer fuscous, legs with longitudinal brown stripes, four on anterior femora; no transverse band present on anterior tibiae.

**Structure:** Frons considerably longer than broad, carinae distinct, obsolete at cephalic margin; forewings but slightly setigerous, extending beyond distal margin of 11th tergite; 11th tergite short, about the length of 10th; 9th tergite with deep dorso-lateral emargination of its distal margin; tibiae very slender.

**Female:** Forewings extend to tip of 11th tergite; somewhat larger but coloration and structure similar to male.

Holotype, ♂, allotype ♀, 8 ♂, 4 ♀ paratypes, Pascagoula, Mississippi, August 8, 1921, C. J. Drake, in the U.S. National Mus. Other paratypes. 1 ♀, Oswego, N.Y., June 25, 1894, 357-157; 1 ♂, Mineral Springs, Indiana, September 1, 1925, (2534, 2539); 2 ♂♂, 7 ♀♀, Beach, Illinois, July 25, 1934, Frison & DeLong; 1 ♂, Kansas City, Missouri, F. Rogers (320); 1 ♂, Leavenworth Co., Kansas, July 7, 1924, R. H. Beamer; 1 ♀, Ball Creek River, Minnesota, July 3, 1935, D. G. Denning; 7 ♀♀, Hecla, South Dakota, June 19, 1933, H. C. Severin, 1 ♀, Waubay, South Dakota, June 22, 1936, H. C. Severin; 1 ♀, Lake Oakwood, South Dakota, August 24, 1923, H. C. Severin; 1 ♀, Lake Poinsetta, South Dakota, August 29, 1927, H. C. Severin; 2 ♂♂, 1 ♀, Montana, P. R. Uhler; 2 ♂♂, 3 ♀♀, Hot Lake, Oregon, July 13, 1931, R. H. Beamer; Paratypes in U.S. National Museum, University of Minnesota, Cornell University, Illinois Natural History Survey, South Dakota State College, and University of Kansas collections.

There is considerable variation in color for this species though in a given locality it is more or less constant. The distal margins of the forewings in the male are usually brown, though they may be greenish-yellow as is the rest of the wing. The frons, and the dorsum in general are variable as far as markings



are concerned. The amount of orange, yellow, and green varies. The specimens from Oregon are somewhat variable in the shape of the genital styles and are somewhat smaller than the average. The length of male specimens varies from 6.5-7 mm. and the forewing length from 6 to 6.8 mm.

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#### Explanation of Plate

1. Dorsal view of head and thorax of *Pentagramma longistylata*
- 1a. Lateral view of male genital capsule of *Pentagramma longistylata*
- 1b. Front of *Pentagramma longistylata*
3. Dorsal view of head and thorax of *Pentagramma vittatifrons* (Uhler)
- 3a. Lateral view of male genital capsule of *Pentagramma vittatifrons* (Uhler)
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4. Dorsal view of head and thorax of *Pentagramma nigrifrons* Muir
- 4a. Lateral view of male genital capsule of *Pentagramma nigrifrons* Muir
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- 5a. Front of *Pentagramma cosquina*
6. Dorsal view of head and thorax of *Pentagramma douglasensis*
- 6a. Lateral view male genital capsule of *Pentagramma douglasensis*
- 6b. Front of *Pentagramma douglasensis*
7. Dorsal view of head and thorax of *Pentagramma variegata*
- 7a. Lateral view of male genital capsule of *Pentagramma variegata*
- 7b. Front of *Pentagramma variegata*





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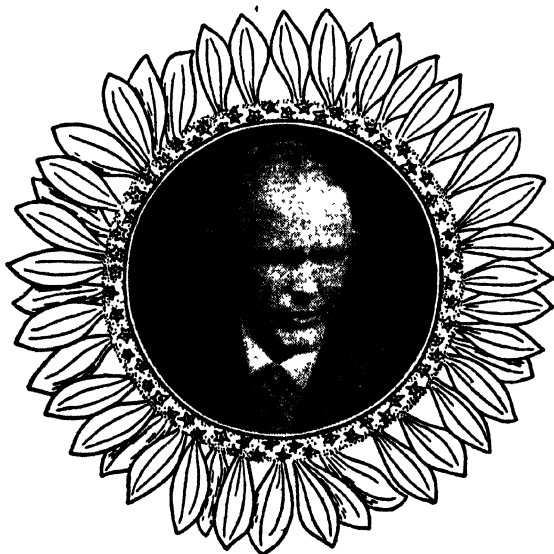
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*This issue mailed May 7th*

# Kansas Entomological Society

Volume 20

APRIL, 1947

Number 2

## THE SIXTEENTH OR 1946 ANNUAL INSECT POPULATION SUMMARY OF KANSAS<sup>1</sup>

ROGER C. SMITH,<sup>2</sup> GEO. A. DEAN,<sup>2</sup> and E. G. KELLY<sup>3</sup>

Kansas Agricultural Experiment Station

The insect population summary for Kansas covers the calendar year 1946 and is the sixteenth in a continuous series which began with the year 1931.<sup>4</sup> The information recorded here is based on a summary of 298 questionnaires of the score card type from the sources indicated<sup>1</sup> in Table I together with the observations and comments of the authors, their colleagues and of those returning the score sheets.

TABLE I.

Sources and Numbers of Questionnaires Summarized for This Report.

	No. in July	No. in October
Group 1. Entomologists in the State .....	11	8
Group 2. County Agriculture Agents .....	73	67
Group 3. Farmers, mostly college graduates .....	11	12
Group 4. Vocational Agriculture Teachers .....	30	60
Group 5. Agronomists and Horticulturists .....	12	14
Total reports of each group .....	137	161
Grand total of all questionnaires summarized for this report .....	298	

### Summary of Weather Conditions (Fig. I and Table II) in Kansas by Months During 1946<sup>5</sup>

January was exceptionally wet over nearly all the eastern part of Kansas and exceptionally dry in the western counties. It was one of the mildest Januaries on the state's record and averaged seven degrees milder than December preceding. There was about the usual amount of sunshine. In the western counties, wheat made little or no growth and was in a precarious

<sup>1</sup>Contribution No. 553 from the Department of Entomology.

<sup>2</sup>Entomologists of the Kansas Agricultural Experiment Station

<sup>3</sup>Extension entomologist, Extension Division.

Recognition and appreciation for assistance given during the preparation of this summary are due to the same sources and largely to the same individuals who supplied information for recent, previous reports.

<sup>4</sup>For the other summaries in this series, see the *Journal of the Kansas Entomological Society* for the summaries for 1931 (vol. 5); 1932 (vol. 6); 1933 (vol. 7); 1936 (vol. 10); 1937 (vol. 11); 1939 (vol. 13); 1942 (vol. 16); 1943 (vol. 17); 1944 (vol. 18); and for 1945 (vol. 19); and the *Transactions of the Kansas Academy of Science* for 1934 (vol. 38); 1935 (vol. 39); 1938 (vol. 42); 1940 (vol. 44) and for 1941 (vol. 45).

<sup>5</sup>Notes and Table II based on Climatological Data: Kansas Section Weather Bureau, U. S. Dept. of Commerce by S. D. Flora. Vol. 60, 1946. See also Kansas Weather by S. D. Flora, *Trans. Kans. Acad. of Science* 49(4): 367-377, Mar. 1947.

**TABLE II.**  
**Summary of Weather Data for the State of Kansas for the period September 1, 1945, to December 31, 1946.**  
 From U. S. Weather Bureau, Kansas Section, Vol. 60.

Month	TEMPERATURE IN DEGREES FAHRENHEIT				PRECIPITATION IN INCHES						
	State Mean	Max-imum	Min-imum	Mean for 58 years	Departure from normal	State Average	Average for 58 years	Departure from normal	Eastern third	Middle third	Western third
1945											
September	69.2°	108°	22°	69.7°	-0.5°	4.89	2.84	+2.05	7.84	5.04	1.79
October	57.4°	93°	14°	57.3°	+0.1°	0.81	1.95	-1.14	0.97	0.87	0.60
November	45.8°	88°	0°	43.3°	+2.5°	0.15	1.25	-1.10	0.33	0.06	0.06
December	27.5°	72°	-24°	33.0°	-5.5°	0.81	0.89	-0.08	1.11	0.88	0.45
1946											
January	34.4°	77°	-3°	30.0°	+4.4°	1.54	0.70	+0.54	2.47	0.98	0.27
February	41.9°	82°	4°	33.4°	+8.5°	0.77	0.99	-0.22	0.95	0.67	0.77
March	52.5°	97°	10°	43.6°	+8.9°	2.21	1.47	+0.74	2.86	1.98	1.80
April	60.4°	97°	22°	54.8°	+5.6°	1.64	2.68	-1.04	3.06	1.27	0.58
May	60.5°	94°	23°	63.8°	-3.5°	3.44	3.80	-0.36	3.53	3.36	3.43
June	75.8°	113°	39°	73.8°	+2.0°	3.16	4.02	-0.86	4.27	2.54	2.68
July	81.3°	111°	50°	79.2°	+2.1°	1.85	3.12	-1.27	1.30	2.23	2.03
August	77.8°	114°	41°	78.0°	-0.2°	2.97	3.18	-0.21	4.17	2.80	1.94
September	68.9°	107°	27°	69.7°	-0.8°	3.66	2.86	+0.80	4.27	3.80	2.99
October	58.4°	92°	25°	57.3°	+1.1°	4.22	1.99	+2.23	2.99	3.81	5.87
November	42.9°	77°	5°	43.3°	-0.4°	2.56	1.27	+1.29	2.34	2.29	3.05
December	38.7°	78°	-12°	33.1°	+5.6°	0.57	0.89	-0.32	1.26	0.42	0.04
Averages, totals or extremes											
for 1946	57.8°	114°	-12°	55.0°	+3.33°	28.29	26.97	+1.32	33.47	26.15	25.45

condition, with the soil so dry that there was great danger of soil blowing.

**February** was an exceptionally mild, sunshiny month for the time of the year and over the northern half of the state was exceptionally dry. It completed a five-month period which in the western two-thirds of the state averaged the driest that had occurred this time of the year since the winter of 1934-35. Most of the northern half of the state had less than half an inch of precipitation. The deficiency was especially noticeable over the northwestern counties. It was a favorable month for farm work. Seeding oats was more than half completed in the south central and southeastern counties and well under way elsewhere. Some gardens were started in the Kaw Valley and fields of potatoes were planted. There was no zero weather in February.

**March** was exceptionally mild, with generally abundant rains and ample sunshine making it a very favorable month for crop growth over the state. Vegetation, especially fruit, was forced almost a month in advance of the season. January, February, and March of 1946 made the mildest three-month period in the state since the state-wide record was begun in 1887. March afternoon temperatures of 70° or higher were frequent, and freezing at nights was rare. March 31 was the warmest day with temperatures of 90° or higher in almost every part of the state with a high of 97° across the central belt. Wheat was jointing in some fields, oats came up with excellent stands, the commercial crop of potatoes was planted under favorable conditions, alfalfa and pastures were well in advance of the season, and all fruit trees, except apples, were in full bloom.

**April** came very nearly being a record-breaker for continued mild weather, with decidedly deficient rainfall over practically all the state except the eastern counties. This completed a four-month period that averaged the mildest ever recorded in the state for the time of the year. All crops were from three to four weeks ahead of the season as a result of the extended mild weather. Wheat was in the boot by the close of the month, with fields of early varieties heading out in the southern counties. The crop was needing moisture and was deteriorating steadily in southwestern and west central areas.

Corn planting was nearly completed in southern and eastern counties and getting underway elsewhere. The first crop of alfalfa, which made a fine growth, was being cut. Pastures were excellent in the eastern counties but were suffering from lack of moisture in the western. Damage by frost during the month was very small, being confined mostly to grapes and strawberries.

**May** was a month of good rains throughout the state except for many dry spots in the eastern counties at the close of the month. The month was abnormally cool with a damaging freeze over the western half on the 11th. With the exception of this freeze it was a favorable month for wheat. In many of the extreme southern counties it was nearing harvest by the last of the month. Corn made a good, though rather a slow, growth. Warm weather the closing day of the month greatly helped it, especially in the eastern counties. The first cutting of alfalfa was made. Pastures grew well.

**June** was the warmest experienced in Kansas in ten years. Rainfall was below normal in the western two-thirds of the state and southeastern counties. Sunshine averaged normal. While some severe storms occurred and



damaged wheat and corn, the number and damage were less than usual for June. Hot dry weather near the middle of the month was trying on growing crops, but wheat ripened fast and filled well. Harvest began earlier than usual. Most of the oats crop was cut. The crop was a good one. Corn made excellent growth. Alfalfa and pastures grew well.

**July** was the hottest and driest July Kansas had experienced during six years. The rainfall was unevenly distributed over the state. Monthly totals of from three to five inches occurred over most of the north central and north-western counties, while the southern half and a number of counties in the southwestern and northeastern parts of the state were in the grip of a severe drought, with monthly totals of less than half an inch in many places. The dry hot weather caught corn at a critical period of its growth, while it was silking and tasseling; the crop deteriorated the latter part of the month, especially in the southern and eastern counties. Pasture, alfalfa, and grain sorghums also made slow growth.

**August** was a month of torrential rains for local areas in the northeast quarter of the state during the second week. The first 17 days of the month were abnormally hot, while the closing week was exceptionally cool.

Corn and grain sorghums were badly damaged by hot weather the fore part of the month. Pastures and alfalfa improved materially the last two weeks. Seed beds had been prepared and in many western counties drilling wheat was underway.

**September** was a month of generous rains and warm weather over most of the state. It was favorable for crop growth and fall seeding.

**October** was the third wettest October on record for Kansas. Over the western third, where totals of five to seven inches were common, it was the wettest October on record. The only parts of the state that remained persistently dry were the southeastern counties. It was an excellent month for the early fall growth of wheat, and by the end of the month the crop covered the ground as seen from the roadside.

Husking corn was well under way. Alfalfa and grass pastures made a good growth. Soybean harvest was well advanced in the eastern counties.

**November** was a month of unusually heavy snow (8 to 10 inches) in the western part of the state, generous rains in almost all sections of the state and mild temperatures. The western third received more precipitation than has been recorded in any other November in 60 years, except one. Since the month followed the wettest October on record in that part of the state the soil was thoroughly soaked. While the northeastern counties received less than normal amounts of rainfall, the moisture was sufficient for current needs. It was a favorable month for wheat, which as a rule covered the ground and had sufficient moisture to carry it through the winter. Farm work was hampered by muddy fields the fore part of the month. The latter part of the month was favorable for corn husking and for combining and threshing grain sorghums.

**December** was a month of warm, dry, and windy weather. It was generally favorable, however, for agriculture and livestock, except for the last four days, when the temperature dropped to as much as 23 degrees below normal.

While the monthly precipitation was below normal, the moisture was received at an opportune time and crops were in favorable conditions for the beginning of the new year.

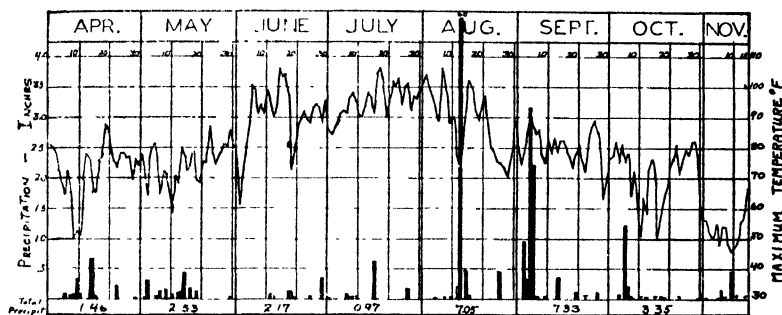


Fig. 1. Daily rainfall and temperature chart for the growing season of 1945 at Manhattan, Kansas. Chart prepared by D. A. Wilbur.

### CROP PRODUCTION SUMMARY FOR 1946<sup>1</sup>

While the 1946 production of Kansas crops was only 1 percent more than in 1945, 1946 was a good year for crops in Kansas. The farm value of the 1946 crop production, \$618,292,000, was the highest on record. It was 22 percent higher than the 1945 value of \$505,128,000 and 7 percent higher than the previous record value of \$578,126,000 in 1919. The 1946 wheat crop was valued at \$396,635,000. The total 1946 wheat crop of 216,768,000 bu. was second only to the 1931 crop of 251,885,000 bu.

While rather favorable conditions were had for seeding of the winter wheat crop in the fall of 1945, dry conditions were encountered in some sections, particularly in the north central area. The crop wintered fairly well, although some damage occurred from soil blowing. Unusually early spring growth was followed by a period of insufficient moisture, but in May the crop was improved by cool weather and rains that enabled the heads to fill well, giving a better than expected yield in many sections.

The hot weather in July and August seriously damaged corn, especially in the southern part of the state. Sorghum development was also retarded, but rains and a late fall enabled the crop to make some late development.

The corn crop is estimated at 63,231,000 bu. compared with 68,563,000 bu. in 1945. The production of all sorghum for grain in 1946 is estimated at 11,488,000 bu. compared with 17,695,000 bu. in 1945. Sorghums for forage totaled 2,083,000 tons compared to 2,273,000 tons in 1945. Production of soybeans is estimated at 2,173,000 bu. compared with 2,350,000 bu. in 1945.

The production of oats is estimated at 40,556,000 bu. compared with last year's light crop of 16,940,000 bu. The barley crop of 5,022,000 bu. compared

<sup>1</sup>From Kansas 1946 Crop Review, Kansas State Board of Agriculture, Statistics Division Dec. 20, 1946. Mimeographed Release.

with 7,086,000 bu. in 1945 is the smallest crop since 1937. Flaxseed crop was 812,000 bu. compared with 2,851,000 in 1945. Damage from late frost in the northern counties reduced the first cutting of alfalfa, and the summer drought reduced the yields in the southern counties.

The harvested potato crop of 1,632,000 bu. compared with 1,394,000 bu. for 1945 was the third smallest crop since 1868. The harvested acreage of 16,000 was the smallest on record. Alfalfa seed production of 387,000 bu. established a new record and compares with 196,000 bu. last year and 238,000 bu. in 1943, the previous record. For several years Kansas has been first in the production of alfalfa seed in the United States. The red clover seed crop of 57,000 bu. also set a new record exceeding the previous crop of 43,000 bu. in 1945. The production of other crops in 1946 and 1945 respectively are as follows: sweet clover seed 106,000 and 100,000 bu.; lespedeza seed 11,900,000 and 9,000,000 pounds; Sudan grass seed 1,800,000 and 2,600,000 pounds; broom corn 1,800 and 1,800 tons; popcorn 6,240,000 and 9,240,000 pounds; commercial apples 466,000 and 270,000 bu.; peaches 122,000 and 72,000 bu.; pears 122,000 and 124,000 bu.; grapes 3,500 and 4,500 tons.

The estimated honey crop was 3,360,000 lbs. or an average yield of 56 lbs. per colony compared with 2,601,000 lbs. or an average yield of 51 lbs. per colony in 1945. The amount of beeswax for 1946 was 67,000 lbs. compared with 52,000 lbs. in 1945.

### DESCRIPTIVE ACCOUNT OF THE MORE IMPORTANT INSECT ACTIVITIES AND CLIMATIC RELATIONSHIPS DURING 1946

**Ants** maintained a high population during 1946 judging by observations and correspondence. Winged forms of several species prompted the usual large number of inquiries from the public. They were, however, scored as high as 3 in only six counties.

**Aphids** in general were normal but the species on iris, chrysanthemums, roses, and columbines were more plentiful than usual. In the general report of aphids, 19 counties scored them as high as 3. They occurred chiefly in gardens. They were reported on beets in Hamilton County, on potatoes in Cloud County, and were scored at 4 on apples in Doniphan County.

**Aphids on snowball** were abundant in early spring over most of the state and continued till blooms formed. They caused much blighting of the blossoms.

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**TABLE III.**

Population summary of the more common and important insects in **Kansas** for 1946, as indicated by questionnaire score sheets from nearly all counties.

#### KEY

- 1 Scarce.
- 2 Plentiful, but damage was neither noticed nor reported.
- 3 The species was abundant. Some damage was either seen or reported.
- 4 Local outbreaks. The species was doing severe damage in certain fields.
- 5 The species was in general outbreak. The insects were doing their greatest damage or were as plentiful as they ever get in a locality.

[illegible]

The **black cherry aphid** was common on cherry and plum in nurseries, especially in northeast Kansas.

**Aphids on iris, tulips and columbine** occurred more widespread than ever observed, but nowhere were they particularly destructive. They were somewhat of a curiosity on these plants.

**Cabbage aphids** were exceptionally plentiful during 1946, and old cabbage stumps in the late fall were heavily infested in Riley County.

**Corn root aphids** appear to be increasing in the northeast section of Kansas where corn is planted year after year in the same fields. The "blue lice" as they are called by growers, caused heavy losses in many fields in the corn counties along the north border of the state.

**Turnip aphids** were also more plentiful than usual during the fall.

**Green bugs** wintered in Kansas as far north as Manhattan and were found widely distributed in wheat fields by R. H. Painter, but natural enemies—lady beetles and parasite *Lysiphlebus*—confined them to small numbers. By early April, it was apparent that green bug would not cause damage to wheat in Kansas but might damage oats. The characteristic green bug damaged spots occurred in many fields in Oklahoma, but no spots were seen or reported in Kansas. The aphids occurred on wheat heads in early May and were reported on oats in Doniphan, Leavenworth, and Lyon counties.

**Pea aphids** were common, widespread, and caused some damage to garden peas during 1946. They occurred in many alfalfa fields early in April, and by the middle of the month they were abundant around Larned and Medicine Lodge. The alfalfa crop cut for dehydrating left young plants exposed to pea aphids and considerable damage followed.

Pea aphids continued to increase and by early May an outbreak in the southern half of the state appeared certain. Whole fields of alfalfa were infested. Some damage occurred in the Garden City area and in the Arkansas Valley. Growing conditions, however, were excellent and little monetary loss resulted. Damage to stands was seen in Riley, Barton and Pawnee counties in May. If growing conditions had been poor in May, there were sufficient aphids in the fields to have caused widespread damage to stands. W. T. Emery found 10 to 20 c.c. of pea aphids in 20 sweeps with a net only in Saline County, May 8-9, while in nine other counties  $\frac{1}{2}$  to 1 c.c. in 20 sweeps occurred. Peas were reported to the extent of a scoring of 3 or 4 in Wyandotte, Woodson, and Stanton counties.

Pea aphids were common in alfalfa fields throughout the long favorable autumn. A parental population sufficient for an outbreak in 1947 provided weather conditions were favorable went into the winter.

**Bagworms on evergreens** continued in 1946 at a high population level. Evergreens in some nurseries were infested, in a few cases severely. Arbor vitae hedges commonly had some bags on the plants. The young bagworms hatched early in June in northern Kansas. They were scored at 4 on cedars in Wyandotte, Shawnee, Atchison, and Lyon counties, at 2 in Cowley County and 1 in McPherson County. They were scored at 1 on sand hill plum in Paw-

nee County. This insect was reported from Wallace, Stevens, Decatur, Finney and Meade counties which is probably a first report of it so far west.

Parasites have been increasing and it is believed that the peak has been passed.

**Blister beetles** increased slightly in 1946. The striped species damaged alfalfa in spots in fields in Riley, Stafford, Barber, and Finney counties. Blister beetles were scored at 4 on garden plants in Wyandotte and Lincoln counties, at 3 on same in Butler and on alfalfa in Wichita counties, and at 1 to 3 in many counties either on alfalfa or gardens or both.

**Bees** produced nearly 30 percent more honey in 1946 than in 1945. (See Crop Production Summary, page 46). Beekeepers in southeastern and south central Kansas harvested a poor crop of honey. The crop, however, was more than average in north central Kansas and good in northeast Kansas. Brood-rearing began early and some trouble with swarming was experienced. The nectar flow was cut short by dry weather the middle of June and there were inadequate sources of nectar until the rains of the second week of August. There was a small long drawn-out fall nectar flow but many beekeepers took off too much of the honey because of the demand and high price; probably many colonies went into the winter with inadequate stores. Sweet clover growth was below average.

**Borers** in trees were widely reported but the damage probably was below average because for much of the year tree growing conditions over the state were good. Borers were reported at 3 in Scott County on elm, ash, and locust, on apple and peach in Greenwood, and ash in Russell counties. They were scored at 2 in Crawford and Seward counties on elms, and elsewhere at 1 to 4 on trees and shrubs in general.

Borers in chrysanthemum stems were reported during September by several correspondents. Borers from Wilson and Johnson counties, Kansas, were cerambycids. The larvae bored downward in the stems causing the stems to die or break off. This condition has not been reported in recent years.

Adults sent in at mid-July from Ellis, Kansas, by Mrs. W. F. Bayles were determined (by comparison) as *Hemierana marginata* (Fab). They were boring in the stems of chrysanthemums and other garden flowers which appears to be an unreported new habit for the species. Mrs. Bayles said the beetles deposited their eggs near the top of the plants and the young hatch inside the stem. She stated they lived in the soil at the roots of the plant until spring and develop into the adult in early summer. The plant is killed.

**Botflies on horses** attained normal numbers during 1946 and were scored from 1 to 3 over the whole state.

**Sheep botflies** were quite serious in Lincoln, Mitchell, and Finney counties.

**Boxelder bugs** which increased during 1946 were pests in homes in the autumn for the first time in several years. The west wall of the first capitol of Kansas at Camp Whiteside was observed the last of September with an exceptionally large number of boxelder bugs on it.

No damage to any plants by these pests was seen or reported during the season.

**Cabbage worms** do not fluctuate in numbers very much, but in Riley

County they appeared to be slightly less of a problem than normal. The results of the use of DDT powder with its residual effect is likely to give the impression to observers of scarcity of this pest.

**Cankerworms** continued at the same low level of population as in 1945. Moths first were noted on bands at Manhattan about the middle of February. Emergence increased for the next month but most bands never had many moths on them. Elm leaves came out possibly three weeks early due to an early spring. No important damage was observed anywhere but slight damage was seen at Leavenworth on a few unsprayed apple trees. Spraying of elms was reported necessary at Parsons.

**Cattle grubs** on native Kansas cattle were less plentiful in 1946 than in 1945, as reported by county agents. The publicity given to its control might lead one to think otherwise since the Extension Service is trying to eradicate the pest from the state. A total of 795,000 head of cattle were treated with derris for grub control during the winter of 1945-1946 and the goal for 1946-1947 is 1,500,000 cattle.

**Cattle lice** appear to have been more plentiful than in previous years, probably because the application of sprays exposes the lice. There were 16,818 farmers who treated 606,500 cattle for lice in 1946.

**Chinch bugs** increased slightly during 1946. Adults were observed to be less numerous than for several years in April. They were observed in fair numbers in barley in southeast and south central Kansas in early May. Winter barley in southeast Kansas was somewhat damaged. The first generation nymphs were plentiful. Some barriers were required at harvest time. Some corn was damaged in south central Kansas counties. As usual, the largest populations occurred in the eastern half of the state and the south central portion of this area.

The fall chinch bug survey showed a threatening population in hibernation from Jewell to Sumner counties eastward. The largest numbers occurred in Wyandotte, Leavenworth, Jefferson, Johnson, Linn, Crawford, Neosho, Woodson, Cowley, Butler, Sedgwick, Harvey, Marion, Ellsworth, Dickinson, and Lincoln counties in all of which they were scored at 4.

**Clover leaf weevils** in alfalfa were virtually absent in 1946. There are no records of their appearance.

**Codling moths** were as numerous as ever, judging by moth catches in bait traps and stings in unsprayed orchards, but where recommended sprayings were done the control was 10 or 15 percent better than usual, according to R. L. Parker. Control with DDT in several of the standard lead arsenate cover sprays gave 98 percent control.

**Colorado potato beetles** continued at a low level in 1946 and were still far below usual numbers. Their marked reduction has been an entomological mystery. Some persons think the control with DDT and other new insecticides and destruction of their eggs by lady beetles were limiting factors. No beetles were seen up to mid-April at Manhattan and in many other sections of the state, but later they were seen on some volunteer plants.

**Columbine leaf miners (*Phytomyza aquilegiae*)** continued to be as serious a pest on columbine as during the last two or three years. The miners appeared

this season about the last of March or the first of April. Even the first generation caused severe damage.

**Common stalk borers** (*Papaipema nebris*) caused injury in the stalks of corn, potato, and tomato plants during the summer in many parts of the state. This species was slightly more plentiful than in 1945.

**Corn root worms** caused some damage to corn in the corn counties of the state in late July after a wind storm. Injured plants fell to the ground because the roots broke off easily.

**Cutworms** were more numerous and destructive in 1946 than for several years. Considerable damage occurred in gardens, sweet clover fields and cornfields during April and early May. They cut off garden plants, especially cabbage and tomatoes, worse than for several years. Several species were more plentiful than usual in many parts of the state. They were reported chiefly in gardens and early corn, and they were scored at 1 to 3 chiefly with a 4 in Jackson County.

Large numbers of cutworm moths emerged in southwest Kansas the latter part of April and early May when the honey locust trees were in bloom. They were as severe a house and garage pest as ever occurs there.

**Elm calligrapha** (*C. scalaris*) beetles began to emerge the latter part of February and early March. By the second week they were plentiful, and by the middle of March thousands were hiding under the cankerworm bands which had been placed around the trunks of the elms. The beetles deposited eggs on the leaves, buds, and twigs. They were abundant at Manhattan and across the central part of the state. The larvae were fully grown by mid-May. The beetle and larvae caused injury to the elms at McPherson, Abilene, and Manhattan. It was necessary to spray many trees. They also were reported feeding on the leaves of black locust and arborvitae at McPherson. Many of the eggs at Manhattan were parasitized by *Erixestus winnemana* Cwfd. (*Microgasteridae*) as determined by A. B. Gahan, Bureau of Entomology and Plant Quarantine. Many specimens were sent to C. F. W. Muesebeck. There was only one record of the occurrence of this parasite since its description in 1910.

**European corn borer** surveys in Wyandotte and Johnson counties (Kansas City, Kansas, areas) disclosed a decided reduction of larvae in 1946. No larvae were found in Wyandotte County and only two larvae each in Johnson County and two in Shawnee County by R. A. Calkins. No larvae were found in the surveys in other Kansas counties.

**European elm scale** was discovered in St. Francis. It had already developed into a considerable infestation extending for several city blocks. It occurred on both American and Chinese elms.

**Scale insects** which resembled mealy bugs collected in Colby, were identified by Harold Morrison as the overwintering stage of the scale. Four trees only are known to be infested with this species at Colby.

The infestation at Goodland was reduced by spraying operations in March.

**Fall webworms** were scarce in Kansas in 1946. A few webs were seen during September but the numbers were below normal. All counties were



scored at 1 or 2 except for 3's in Greely, Wilson, Crawford, and Wyandotte counties.

**Fall armyworms** were scarce in 1946 but they were reported from all parts of the state. All scores were 1 or 2 except for 3's in Hodgeman and Sedgwick counties.

**False wireworms** were somewhat more plentiful in the western four or five tiers of counties than in 1945. Rush County was scored at 4 but the other western counties scored these pests at 2 or 3. Damage to sorghum seed was reported in Hodgeman County.

**Fruit tree leaf-rollers** were common, and during June damaged the foliage of young apple trees in the Kansas City, Kansas, district and at Wathena. Codling moth sprays did not control them. Cocoons were received from Topeka early in May. This species has lately invaded the state and is still uncommon, but it appears to be spreading westward. The light green pre-pupa winters in the grayish-brown cocoons.

**Fleas** in houses and on pets were widely reported in the state, but it is believed the numbers were no more than average. These pests were scored at 4 in Greely, Stafford, Jefferson, Atchison, and Wyandotte counties, at 3 in 13 counties, and at 2 in 32 counties.

**Flies** in general were possibly average in numbers throughout the state, which means they were moderately abundant in most parts of the state. They were not in outbreak at any time.

**Horn flies** were only moderately plentiful in 1946. The first widespread spraying of cattle to protect them from horn flies occurred during 1946; 1,326,000 head of cattle were sprayed with 0.2 percent DDT with excellent results. Spraying with DDT has now become standard ranch practice.

Horn flies first reached noticeable numbers about April 9 and continued without large peaks until November. They increased following the August and September rains. They have been scored at 5 only in Lane, Osborne, Stafford, McPherson, and Jefferson counties; at 4 in 50 counties; and at 3 in 36 counties.

**Houseflies** were reported from almost all counties but were below average in abundance. Three counties—Wyandotte, Jefferson, and Shawnee were scored at 3, and 41 counties were scored at 2.

The organized livestock insect control program for 1946 reached almost every county in the state. In 92 counties, there were 241 power spraying machines operating for control of the several insects that attack livestock. Many tons of rotenone-bearing powders and also many tons of DDT powder were used. The control of stable flies, houseflies, and horn flies led the parade; 29,400 farmers treated their barns and out-houses for stable and house flies.

**Screw worms** were troublesome pests from the latter part of March to November. During this abnormally long period of infestation the peaks occurred in April and September. In the spring, they attacked navels of young animals and dehorning wounds primarily.

A survey in early September showed them to be relatively plentiful from

Kansas City to Manhattan, south to the Oklahoma line. They were mostly in cuts and wounds in cattle and hogs.

**Grasshoppers** increased somewhat in 1946 but their numbers were well below normal. They were most numerous in some 11 western Kansas counties during September when the state and federal agencies scattered tons of poisoned bait along roadsides.

Grasshoppers hatched a few days before April 6 in the Garden City region. Nymphs of several species were in the second instar by mid-May. The two-striped were observed abundant and doing damage in two garden plots at Oberlin and Kansas City. Definite flights of the lesser migratory grasshopper, *M. mexicanus* were observed by Fred Butcher, Bur. of Ent. and P.Q., in the Garden City region in mid-June and by county agents in September in the western counties. Eggs were deposited before July 1 in that region. The second generation appeared fully two weeks earlier than usual. Damage by grasshoppers was light in central and eastern Kansas and confined to the borders of alfalfa fields. The grasshopper damage to edges of wheat fields in Greely, Wichita, Clark, Lane, Finney, Kearney, Grant and Hamilton counties was severe. The counties of Jefferson, Wyandotte, Shawnee, Johnson and Miami were scored at 4 and 38 other eastern and central counties at 3. It has been determined that the normal population for grasshoppers in Kansas by analysis of the previous 15 summaries was approximately 3.5.

There was a small partial third generation of *M. mexicanus* in southwest Kansas this year. The late second generation nymphs and early third generation nymphs were found feeding on early planted wheat in 16 western counties.

Carolina adults were reported in some areas in southwest Kansas. Mr. M. W. Smerchek, County Agent of Stanton County, counted as many as 100 per square yard west of Johnson.

**Garden webworms** were largely confined to the eastern half of the state according to reports, and they were scarce there. This species was scored at 3 on alfalfa only in Neosho, Wilson and Reno counties.

**Green striped maple worms** (*Anisota rubicunda*) defoliated many soft maple trees in the southern part of Jefferson County and northern part of Douglas county during July and August.

**Hessian fly** caused a heavy loss to the wheat crop in several counties in south-central and southeast Kansas by the fall (1945) generation. There also was some damage to wheat in northeast Kansas.

Eggs and larvae were observed April 4, fully two weeks earlier than usual. R. H. Painter found eggs of the fly on March 25 in the variety wheat tests in Rice County, in central Kansas. He also found larvae in the flaxseed stage, April 16, in the Manhattan field tests. E. T. Jones, Bureau of Ent. and P.Q., made a trip April 8 through Riley, Geary, Dickinson, Clay, and Marion counties and some southeastern counties during which he found half-grown larvae. A large percent and in many instances all of the fall infested wheat plants had been killed, despite the warm weather.

This first spring emergence was heavy and many tillers were killed before they began to joint. This resulted in thin stands carrying heads. A number of infested fields were plowed under in May. In most fields the second spring generation was light and occurred high on the stem, causing relatively little lodging. Weather conditions were favorable for wheat growing in central Kansas; and heavily infested fields produced a number of bushels per acre, though much less than more lightly infested fields in the neighborhood. Although fly could be found there was little damage to Pawnee wheat from the insect. There was a large increase in acreage of Pawnee variety. The area of greatest fly injury was in a narrow triangle from Mitchell to Chautauqua and Barber counties, where the loss was estimated at more than 6 million bushels.

Because of the cool fall (1946) a heavy emergence of fly occurred in late August and early September. Volunteer wheat was heavily infested and often killed by the fly. The second generation was scattered and very light in most localities. Where farmers destroyed the infested volunteer there was little evidence of this insect in seeded wheat except in very early planted fields. During this year only a few specimens of hessian fly could be found in fields in the western half of the state.

**Iris borers** (*Macronoctua onusta* Grote) were reported in abnormally large numbers on the grounds of St. Benedicts College, Atchison. Specimens in June were thought to be one to three weeks old. A disease killed fully 75 percent of the larvae. They were eradicated by the disease and by hand destruction.

**Imbricated snout beetles** caused some damage to strawberry plants in northeast Kansas during early April.

**Imported currant worms** defoliated gooseberry bushes beginning the second week in April.

**Japanese beetles** were not taken in more than 500 traps operated for a month in eastern Kansas.

**Leafhoppers** were average in numbers in 1946 and no more plentiful than in 1945. They were scored at 4 on gardens in Ellis and Jackson counties, and at 3 on potatoes, alfalfa and grapes in 14 counties.

**Juniper mealy bugs** (*Pseudococcus juniperi*) were wide-spread in the southern part of the state according to H. B. Hungerford. Control was undertaken at Wichita, Pratt, Medicine Lodge, Winfield, and Great Bend. The infestation in Greensburg was eradicated. It reappeared near Greensburg and at Coldwater. It continued to spread in Wichita. DDT has given excellent control. Cedar trees seriously infested were observed at Winfield. It is worst in southwest and central counties.

**Lice and Mites** on poultry were probably no more numerous than usual in 1946, but publicity campaigns for control emphasized them.

There were more farm people treating poultry for poultry pests than in previous years. There were 20,815 farmers in 97 counties treating their poultry houses and they treated 2,177,940 birds for mites, lice, and bedbugs.

**Millipedes** were sent in by correspondents for identification more frequently during 1946 than at any time within the memory of the authors.

They were collected crawling on the walls and floors of homes during September and October chiefly. One person said they had been crushed by automobiles in such numbers in central Kansas that the highway had a peculiar oily appearance.

Mites were characterized by abnormally large numbers only of red spider mites and average numbers of other species.

**Red spider mites (*Tetranychus telarius*)** severely infested red cedars during the summer throughout nearly all parts of the state. In some areas, the mites spun an unusual amount of web. They also attacked the *Arbor vitae* in some areas.

Damage also was done to apple, spiraea, various flowers, and to some garden plants, particularly beans. The hot, dry weather of the early summer favored this pest. The mites also constituted a problem on DDT sprayed apple trees in the late summer. This pest was considered in outbreak this year. The mites were scored at 4 on cedars in Wyandotte and Ellis counties, and at 3 in 19 counties mostly on cedars except on elms in Osborne County.

**Chiggers** were slightly less plentiful and annoying in 1946 than in 1945. In fact they were below normal despite a dry summer.

**Mange** on hogs was unusually prevalent during the fall of 1946. 3,696 farmers treated 49,160 head of hogs by dipping in lime-sulphur solution for mange.

**Mosquitoes** were scarce until late summer and early fall when they were in virtual outbreak in many eastern counties. The hot, dry weather in many sections of the state was not favorable to mosquito breeding. Even the salt lakes in Rice County were almost dried up during the summer. But many depressions in fields and along roadsides filled with water during the heavy August rains and several species of pest mosquitoes, notably *Culex vexans*, *C. tarsalis*, and *Psorophora cyaneescens* became abundant over a large part of Kansas. The heavy rains and overflow of streams during July, August, and September favored them. The adults made evening work in gardens and around shrubbery in Riley County almost impossible by their bites. They continued annoying until mid-October and were present until early November.

Mosquitoes were scored at 4 in Scott and Dickinson counties, with annoyance to cattle and man mentioned from the former county. They were scored at 3 in 27 counties.

**Oriental fruit moth** larvae caused less injury than last year to peaches in the peach areas, despite the bumper crop. It is present over most of the state and the first or twig generation was about normal, but the second and third generations were scarce. R. L. Parker reported no increase in this insect in south central and southeast Kansas counties.

**Rose slugs** were abundant in many parts of northeast Kansas and in Riley County where they were scored at 4. This pest is still below average over most of the state.

**Sheep ticks** were stressed in Extension Service control programs. Their control is important for the native flocks as well as the imported lambs; 2,419 farmers treated 141,460 head by dipping in Cooper's dip and spraying with DDT.

**Southern Corn Leaf Beetles** (*Myochrous denticollis*) were reported as abundant by the Shawnee County Farm Bureau agent, injuring young corn plants in June.

**Southern Corn Rootworms** (*Diabrotica duodecimpunctata*) were reported injuring corn in northeastern Kansas.

There was more replanting of corn this year than for many years. Wireworms, cutworms, flea beetles, common stalk borers and the two above species were most commonly the cause.

**Stored grain insects**, according to R. T. Cotton, "In farm-stored wheat in Kansas were rather high this year, doubtless as a result of high moisture conditions. In the course of a survey conducted in one of the largest wheat growing counties in central Kansas in September, infestation in farm bins ranged from 1 to 213 insects per quart sample of wheat, with an average of 34 insects per quart. In these samples, 13 different species of insects were represented. In order of numerical abundance they were the flat grain beetle, cadelle, saw-toothed grain beetle, red flour beetle, small-eyed flour beetle, granary weevil, rice weevil, lesser grain borer, Indian meal moth, foreign grain beetle, hairy fungus beetle, long-headed flour beetle and larger cabinet beetle."

These insects were scored at 4 in Osborne, Stafford, Jefferson and Crawford counties and at 3 in 44 counties. They were reported chiefly in wheat and sorghum seeds.

**Southwestern Corn Borer** (*Diatraea grandiosella*) larvae survived the winter of 1945-46 in good condition. In some fields observed by R. H. Painter, larvae were found in all stubble examined. D. A. Wilbur determined that the 1946 infestation was the lightest experienced by Kansas corn growers in the center of the infested area, since the initial outbreak in 1941. Both first and second generation broods were below the 1945 level.

**Squash bugs** were as abundant in 1946 as in 1945. They were scored at 3 in 10 counties, including areas along all four borders of the state.

**Sweet potato leaf beetle** (*Typophorus viridicyaneus*) (Crotch) surveys by L. A. Calkins revealed its presence in early summer in beds in Cowley and Sumner counties. However, this pest seems to have disappeared and market potatoes in September showed no damage.

**Tabanids** were unusually abundant in Eastern Kansas and caused much torment to cattle and horses. The heavy rains and overflows of streams in several districts during the summer made favorable breeding conditions; several species including notably a black and brown species attained abnormally large numbers. They were particularly plentiful in Wabaunsee and in all counties from Ft. Scott to Wathena.

**Tent caterpillars** were reported on trees during April at Parsons. They were scored for the season at 4 from Stafford County and at 3 from Pawnee. In general they were below normal and less numerous than in 1945.

**Termites** were average in numbers in 1946 and no more troublesome than in 1945. They were scored at 3 in 33 counties which included all but the western two tiers of counties.

**Tomato horn worms** were widely reported in the state but they were

probably not more numerous than in 1945. They were scored at 3 only in 9 counties.

**Walnut caterpillars** were again at a low level of population in the state. They were scored at 3 only in Sedgwick, Butler, and Neosho counties.

**Wheat stem maggots** (*Meromyza americana*) were reported injuring wheat in Washington and Rush counties during the late spring.

The **wheat strawworm** was more abundant in Kansas in the 1945-46 wheat crop than in the previous crop or than normal.

**White grubs** were more abundant and destructive during 1946 than for two or three years. They were particularly destructive in the late spring. They were reported doing damage near Bennington in mid-April. Adults of *Phyllophaga crassissima* and *P. rugosa* appeared at Manhattan during mid-April which was fully two weeks earlier than usual. The adults were reported eating the foliage of hollyhocks at this time.

**Cyclocephala immaculatus** grubs were abundant and caused injury to wheat throughout west Kansas on fall sown wheat. While fallowing is a recommended control, they were present in some fallowed ground. The adults were observed eating the foliage of beans. This is a new and previously unreported feeding habit.

This insect injured wheat in several of the western Kansas counties. It was scored at 4 in Rawlins, Pawnee, Ellis, and Thomas counties.

**Wireworms** were more numerous than during the last three years according to H. R. Bryson. They were widely reported in the state but were scored at 3 only in Wyandotte, Crawford, Neosho, Woodson, Riley, Rush and Seward counties. They were scored at 2 in 20 counties. They were reported most frequently damaging corn and sorghum.

## SUMMARY AND CONCLUSIONS

The year 1946 was an excellent crop year and generally speaking, a year of predominately pleasant weather. The year opened with mild average temperatures and adequate moisture for four months. May was cold with some moisture, except in the western third of the state. The summer was dry and above normal in temperature. The western third of the state had a larger rainfall during the summer than usual during the summer and fall, which largely accounted for the splendid harvested wheat crop and the exceptional stand of fall sown wheat. The autumn was mild and moisture conditions were generally satisfactory. The year had the longest growing season in the history of the state. It extended from March 15 to November 11. December was warm and dry.

The yields of all crops except corn and potatoes in 1946 compared favorably with the yields of 1945, both of which were excellent crop years.

The following insects and related forms occurred in outbreak numbers (scored at 5) during 1946; none, but mosquitoes in September in many localities in Eastern and Central Kansas and red spiders in the Eastern fourth of the state approached outbreak numbers.

The following species, with those listed under outbreaks, were more numerous in 1946 than in 1945: aphids on chrysanthemums, columbines, cabbage, turnips, and roses, blister beetles, box elder bugs, chinch bugs, columbine leaf-miner, common stalk borer, corn root aphids, cutworms, European elm scale, false wireworms, fruit tree leaf-rollers, grasshoppers, garden webworms, hessian fly, iris borers, millipedes, stored grain pests, tabanids, wheat straw worm, white grubs, and wireworms.

The following species were as plentiful and destructive in 1946 as in 1945: ants, aphids on apples (Doniphan county), cherry and plum seedlings, bagworms, bot flies, codling moth, corn root worms, fleas, green striped maple worms, leafhoppers, juniper mealy bug, lice and mites on poultry and hogs, sheep ticks, squash bugs, termites, tomato horn worms, wheat stem maggots, *Cycocephala immaculatus*.

The following species were less plentiful and destructive in 1946 than in 1945: elm calligrapha, green bug, pea aphids, borers, cabbage worms, canker worms, cattle grubs, cattle lice, horn flies, house flies, screw worm flies, chiggers, oriental fruit moth, rose slugs, southwestern corn borer, tent caterpillars.

The following species were scarce or absent in 1946: Clover leaf weevils, Colorado potato beetle, European corn borer, Japanese beetle, fall webworms, fall armyworms, walnut caterpillars and other datanas.

## SOME NEW SPECIES OF DELPHACODES (Continued) WITH TWO OLD ONES

(Homoptera, Fulgoridae, Delphacinae)

R. H. BEAMER\*

Lawrence, Kansas

### *Delphacodes fallax* Muir

*Delphacodes fallax* Muir, F., Bull. Exp. Station Hawaiian Sugar Planters Association. No. 18, Aug. 28, p. 33, 1926

#### Brachypterous Form:

Resembles *D. fulvidorsum* (Metcalf) but elytra of male reaching tip of abdomen, genital capsule black on dorsum and aedeagus with lateral tooth at apex. Length ♂ 2 mm.; ♀ 2.2 mm.

**Structure:** Front slightly less than three times as long as wide, almost parallel margined, sides feebly converging on either end, distinctly tricarinate; crown almost as wide between eyes as long, definitely carinate; elytra widest near middle with apices broadly rounded, veins raised, in male reaching to tip of abdomen, in female covering next to last segment

**Color:** General ground color stramineous; in female ovipositor and sheath usually dark, sometimes ventral segments of abdomen more or less infuscated; in male elytra and abdomen, except large basal spot and dorsum of anal segment, black.

\*Contribution from the Department of Entomology, University of Kansas.

**Genitalia:** In lateral view anal segment with pair of large straight sword-shaped processes; aedeagus widest at base, about four times as long as basal width, almost straight, with a pair of lateral, retrorse, apical teeth, each almost as long as apical width of shaft; styles long, bent dorsally near base, apical third slightly curved caudally and tapered to rounded apices.

Holomorphotype ♂, allomorphotype ♀, 4 ♂ and 1 ♀ paramorphotypes, Brownsville, Tex., Dec. 29, 1945, R. H. Beamer; other paramorphotypes: 3 ♂ ♂ and 9 ♀ ♀, same place and collector, Dec. 27, 1945.

#### **Macropterous Form:**

Like the brachypterous form except elytra extend more than their length beyond abdomen, widest beyond cross veins, claval area often more amber colored and veins beyond cross veins darker.

Allotype ♀ and 4 ♀ parallotypes, Brownsville, Tex., Dec. 29, 1945, R. H. Beamer; swept in Palm Forest. 14 ♂ ♂ were also taken with the same data one of which was compared with the type of *D. fallax* Muir by Doctor Elwood Zimmerman.

Muir described this species from one specimen, a short winged ♂, Belem, Brazil, June, 1924. Now in Bernice P. Bishop Museum, Honolulu, Hawaii.

#### ***Delphacodes shermani* (Metcalf)**

*Liburnia shermani*. Metcalf, Z. P., Jour. Elisha Mitchell Soc. Vol. 38, p. 207, 1923.

#### **Brachypterous Form:**

**Resembles *D. campestris* (VanD.)** but both sexes with at least several black spots and male with two short, sharp spines on anal segment. Length ♂ 2.3 mm.; ♀ 3 mm.

**Structure:** Front with sides almost parallel on basal two thirds, slightly converging near apex, definitely more so on basal third, distinctly though lightly tricarinate; crown about one-third longer than width between eyes, carinae very faint; elytra broadest near middle, almost reaching tip of abdomen in male, ending near middle of abdomen in female, narrowing to rounded apices, semihyaline, veins heavier with sparsely set, long yellow setae, hind wings absent.

**Color:** General color buff; male with black spot above each coxa; entire front including areas beneath and back of eyes, except small area at base, a narrow dash either side on dorsum near base of abdomen, a broader cross band near middle and all of genital capsule, except extreme dorsum and anal tube, dark; female with black spots above hind and middle coxae and beneath ocelli, tan across front, a small indistinct dark spot on lateral margin of each dorsal sclerite of abdomen, ovipositor sheath darker.

**Genitalia:** In lateral view male anal segment with two short sharp processes; aedeagus about three times as long as wide, rather rectangular in shape with one strap-like tooth at outer ventral corner and several more or less definite teeth at outer dorsal edge; styles more or less avicephaliform with large head and small beak, in ventral view this head is still more pronounced.

Described from 1 ♂ and 6 ♀ ♀, Raleigh, N. C., in collection of Doctor



Z. P. Metcalf. Redescribed from 140 specimens taken in Douglas Co., Kans., 1945-1946.

***Delphacodes canina* n. sp.**

**Brachypterous Form:**

Resembles *Delphacodes parvula* (Ball) but definitely smaller, elytra scarcely longer than broad and aedeagus in lateral view not bent ventrally near tip. Length ♂, 2.0 mm.; ♀ 2.5 mm.

**Structure:** Front about twice as long as wide, widest just before apex, about one third narrower at base than at widest place, definitely tricarinate; crown definitely longer than shortest distance between eyes, carinae faint; elytra of male barely longer than wide, apices rounded, veins raised, elytra of female definitely longer than broad, apices sharper than in male; hind wings in both sexes mere pads.

**Color:** General color dirty stramineous; female with a variable number of darker spots on lateral margins of last two or three dorsal segments of abdomen; male with dorsum of abdomen more or less fumously lineate.

**Genitalia:** In lateral view anal segment large with a pair of very small caudo-dorsal teeth; aedeagus widest on outer third, slightly more than twice as long as greatest width, with four small teeth dorsally at basal third, a much larger one before broadly rounded apex, three smaller teeth on margin between this and opening and three blunt ones near middle of ventral margin; styles pediform with deeply hollowed foot and bifid toe.

Holotype ♂, allotype ♀, 1 ♂ and 9 ♀ paratypes, Santa Rita Mts., Ariz., Aug. 18, 1935, R. H. Beamer.

**Macropterous Form:**

Like the brachypterous form except with flight wings: Elytra extending about one third their length beyond abdomen, semihyaline with veins darker, widest near region of cross veins, apices rounded. Total length of body and wings ♂ 3.0 mm.; ♀ 3.3 mm.

Holomorphotype ♂, and allomorphotype ♀, Santa Rita Mts., Ariz., Aug. 18, 1935, R. H. Beamer.

Types in Snow Entomological Collections.

***Delphacodes caerulata* n. sp.**

**Brachypterous Form:**

Resembles *D. alexanderi* (Metc.) but more nearly black throughout, aedeagus straight without teeth at tip and styles slender with avicephali-form apices in lateral view. Length ♂ 2.1 mm.; ♀ 2.3 mm.

**Structure:** Front almost three times as long as wide, widest a little below the middle, slightly tapered toward each end although in middle region sides almost parallel, distinctly tricarinate; crown barely longer than wide, smooth on anterior half, distinctly carinate on basal; elytra broad reaching about to genital capsule in ♂, in ♀ extending on to 4th abdominal segment,

apices truncately rounded; hind wings reduced to a flap about one fifth size of eye.

**Color:** General color dark throughout; head, thorax, basal segment of abdomen and border of segment next genital capsule lighter; eyltra, most abdominal segments, and genital capsule except anal tube, coal black.

**Genitalia:** In lateral view, anal segment with two sharp processes; aedeagus long, widest near middle, sides almost parallel with row of teeth diagonally crossing shaft near middle; aedeagal brace about two thirds as long as style, rounded at apex; styles wide at base narrowed toward aicephali-form apices.

Holotype ♂, allotype ♀, 4 ♂ and 1 ♀ paratypes, Douglas Co., Kans., Aug. 27, 1945, R. H. Beamer; other paratypes: 3 ♂ ♂, Aug. 23, 1945, 2 ♂ ♂, Aug. 22, 1945, same place and collector; 12 ♂ ♂, Lawrence, Kans., Aug. 23, 1944, R. H. Beamer; 1 ♂, Medora, Kans., Aug. 5, 1945, R. H. Beamer; 8 ♂ ♂ Douglas Co., Kans., April 12, 1946, R. H. Beamer; 1 ♂ same place and collector April 16, 1946, and 1 ♂ April 18, 1946; 1 ♂ Lawrence, Kans., Sept. 4, 1944, R. H. Beamer.

**Macropterous Form:**

Like the short-winged form except eyltra whitish, semihyaline, widest beyond cross veins and extending one third their length beyond abdomen.

Holomorphotype ♂, Cherokee Co., Kans., Aug. 31, 1927, R. H. Beamer; paramorphotypes: 1 ♂, Douglas Co., Kans., Aug. 22, 1945, R. H. Beamer; 1 ♂, same place and collector, Aug. 27, 1945; 1 ♂, Lawrence, Kans., Sept. 4, 1944, R. H. Beamer.

Types in Snow Entomological Collections.

***Delphacodes peneparvula* n. sp.**

**Brachypterous Form:**

Resembles *D. parvula* (Ball) but posterior margin of male pygofer in lateral view scarcely concave, aedeagus almost straight and aedeagal brace not conspicuous. Length ♂ 2.5 mm.; ♀ 2.8 mm.

**Structure:** Front about twice as long as wide; widest on apical third, slightly narrowed toward either end, more so toward base, strongly tricarinate; crown about one third longer than basal width, carinae definite on basal half, apex broadly rounded; elytra semihyaline, reaching to about middle of abdomen, apices broadly rounded; rather widely separated on mesal line; hind wings mere pads about one third as large as an eye.

**Color:** General color stramineous, dorsum more or less lineate with darker; a dark spot below each ocellus, a second above middle coxae in ♀ and a third and larger spot above hind coxae in ♂.

**Genitalia:** In lateral view; male pygofer very slightly concave on posterior margin; anal segment without processes; aedeagus with sides almost parallel, enlarged at apex with row of about 10 teeth starting on dorsal margin at tip and curving to about ventral margin near middle of shaft, also 6 to 8 teeth on ventral margin on outer third; styles pediform with large heel.

Holotype ♂, allotype ♀, 24 ♂ and 25 ♀ paratypes, Meade Co., Kans.,

Aug. 14, 1945, R. H. Beamer. One paratype Wichita Nat., Forest, Okla., June 26, 1946, R. H. Beamer.

**Macropterous Form:**

Like the short winged form except both pairs of wings extending about one fourth their length beyond abdomen. Length ♂ 3.8 mm.; ♀ 3.8 mm.

Holomorphotype ♂, Benton, Ky., June 30, 1939, R. H. Beamer; allomorphotype ♀, Sinton, Tex., July 5, 1936, D. R. Lindsay; 1 ♀ paramorphotype, Wichita, Nat., Forest, Okla., June 27, 1936, R. H. Beamer; 1 ♀ paramorphotype, Meade Co., Kans., Aug. 14, 1945, R. H. Beamer.

Types in Snow Entomological Collections.

***Delphacodes perusta* n. sp.**

**Brachypterous Form:**

Resembles *Delphacodes analis* (Crawf.) but smaller, lacking tooth on ventro-caudal margin of anal segment and outer half of aedeagus pediform. Length ♂ 1.7 mm.; ♀ 2.0 mm.

**Structure:** Front slightly more than twice as long as wide, widest near middle, slightly narrowed to apex, more so on basal third, definitely tricarinata; crown slightly longer than width between eyes, carinae rather faint; elytra almost rectangular, broadly rounded at apices, extending to about middle of abdomen in both sexes.

**Color:** Female stramineous throughout with slightly darker ovipositor and sheath; male dirty grayish brown on head and pronotum to generally black on abdomen, with a large lighter spot on dorsum of abdomen at base and some lighter spots on lateral margins; legs much lighter.

**Genitalia:** In lateral view anal segment with a broad and short almost double tooth on each side; aedeagus six or so times as long as wide, pediform on outer half, more or less covered on that portion with fair sized teeth; styles widest at base, pediform on outer half.

Holotype ♂, allotype ♀, 55 ♂ and 38 ♀ paratypes, Dunkirk, N. Y., July 20, 1946, R. H. Beamer; other paratypes: 12 ♂♂ and 10 ♀♀, Fredonia, N. Y., July 21, 1946, L. D. Beamer; 8 ♀♀ and 7 ♂♂, Lancaster, N. Y., July 25, 1946, R. H. Beamer; 19 ♂♂ and 9 ♀♀, Rome, O., July 19, 1946, R. H. Beamer.

**Macropterous Form:**

Like the brachypterous except wings fully developed. Elytra extending at least one third their length beyond abdomen, whitish semihyaline with veins much darker. Both sexes quite dark in general appearance to naked eye.

Holomorphotype ♂, allomorphotype ♀, 28 ♂ and 31 ♀ paramorphotypes, Dunkirk, N. Y., July 20, 1946, R. H. Beamer.

All types in Snow Entomological Collections.

***Delphacodes nigriscutellata* n. sp.**

**Brachypterous Form:**

Resembles *D. shermani* (Metcalf) but crown black as well as front, scutel-

lum black and female generally without black marks. Length ♂ 2.3 mm.; ♀ 3.0 mm.

**Structure:** Front slightly more than twice as long as wide, greatest width beyond middle, slightly narrowed toward apex, more so toward base, practically without carinae; crown slightly longer than width between eyes; elytra barely longer than wide, veins raised, apices almost truncate.

**Color:** General color stramineous; female with ovipositor and sheath slightly darker; male with front, including crown and genae, a large spot above middle coxae, scutellum, broad band across middle of abdomen and genital capsule except anal segment, black; elytra often embrowned, hyaline with veins darker, also a slightly darker spot above hind coxae

**Genitalia:** In lateral view anal segment with a pair of long closely appressed processes; aedeagus broadest at base, about one third as wide as total length, rapidly narrowed at basal third to one third basal width, ventral margin incurved on apical third, apex narrowed and curved ventrally; styles with caudal projection near base, unevenly bilobed on apical third.

Holotype ♂, allotype ♀, 18 ♂ and 52 ♀ paratypes, Douglas Co., Kans., April 18, 1946, R. H. Beamer; other paratypes same place and collector: 15 ♂ ♂ and 10 ♀ ♀, April 24, 1946; 7 ♀ ♀, April 29, 1946; 4 ♂ ♂, April 12, 1946; 1 ♂ May 21, 1946.

#### **Macropterous Form:**

Like the brachypterous form but with flight wings. Elytra extending past abdomen by one third their length; widest in region of cross veins, apices rounded, hyaline, veins slightly darker.

Holomorphotype ♂, Meade Co., Kans., Sept. 13, 1944, R. H. Beamer; allomorphotype ♀, and 5 ♂ ♂ paramorphotypes, Douglas Co., Kans., April 18, 1946, R. H. Beamer; 1 ♂ and 1 ♀ paramorphotypes same place and collector April 16, 1946.

Types in Snow Entomological Collections.

This species was collected in Douglas Co., Kans., by sweeping around the edge of a marsh which had a fair stand of *Andropogon furcatus* Muhl. It was not taken in any other stand of this grass although several other locations were swept.

### ***Delphacodes atridorsum* n. sp.**

#### **Brachypterous Form:**

Resembles *D. nitens* M. and G. but smaller, aedeagus bent dorsally almost at right angles and not enlarged at tip. Length ♂ 2.0 mm.; ♀ 2.2 mm.

**Structure:** Front about a third longer than wide, widest in the middle and narrowed about equally toward each end, with large median carina on apical half, evanescent at either end; crown about as wide as long, broadly rounded at apex, practically without carinae; pronotal carinae barely visible; elytra about as broad as long, barely reaching second abdominal segment, truncately rounded on apices; hind wings practically absent.

**Color:** Male dark brown to black except antennae, genae, clypellus, beak,

venter of thorax and legs stramineous; female stramineous, ovipositor and ocelli darker.

**Genitalia:** In lateral view genital capsule about rectangular; anal segment with a pair of long, sharp curved processes; aedeagus widest at base, almost half as wide as long, bent dorsally and strongly tapered on outer two thirds with about 8 teeth near base and 6 on dorsal margin just short of apex; styles widest at base, slightly curved dorsally, apices sharp on ventral margin, in caudal view oval at base with avicephaliform apex with sharp beak on inner margin.

Holotype ♂, allotype ♀, 6 ♂ and 2 ♀ paratypes, Lapine, Ore., July 2, 1935, R. H. Beamer.

Types in Snow Entomological Collections.

### *Delphacodes sagittata* n. sp.

#### **Brachypterous Form:**

Resembles *D. parvula* (Ball) but much smaller, no dark markings, with four short processes on anal segment and a more or less sagittate aedeagus. Length ♂ 1.8 mm.; ♀ 2.0 mm.

**Structure:** Front about one half as wide as long, widest on outer third, definitely narrowed toward each end more so toward base, definitely tricarinate; crown almost twice as long as wide, apex broadly rounded, carinae evident on basal half; elytra semi hyaline, sides almost parallel, apices broadly rounded, extending to about middle of abdomen; hind wings reduced to very small pads about one fourth as large as an eye.

**Color:** Stramineous throughout. ..

**Genitalia:** In lateral view anal segment with two pairs of short processes; aedeagus almost three times as long as greatest width, widest beyond middle, most of enlargement on ventral margin, one large sharp tooth on dorsal margin near tip and about five smaller ones on same margin near outer third; styles pediform, heel very large, base deeply concave.

Holotype ♂, allotype ♀, 1 ♂ and 5 ♀ paratypes, Okefenokee Swamp, Ga., July 25, 1939, R. H. Beamer.

All types in Snow Entomological Collections.

#### **Plate I**

1. Lateral view of genital capsule of male of *Delphacodes fallax* Muir.
- 1a. Caudal view of styles and aedeagal brace of *Delphacodes fallax* Muir.
- 1b. Lateral view of tip of aedeagus of *Delphacodes fallax* Muir.
- 1c. Dorsal-ventral view of tip of aedeagus of *Delphacodes fallax* Muir.
2. Lateral view of genital capsule of male of *Delphacodes nigripennata* Beamer.
- 2a. Caudal view of styles and aedeagal brace of *Delphacodes nigripennata* Beamer.
- 2b. Lateral view of aedeagus, enlarged, of *Delphacodes nigripennata* Beamer.
3. Lateral view of genital capsule of male of *Delphacodes silvae* Beamer.
- 3a. Caudal view of styles and aedeagal brace of *Delphacodes silvae* Beamer.
- 3b. Lateral view of outer two thirds of aedeagus of *Delphacodes silvae* Beamer.
4. Lateral view of genital capsule of male of *Delphacodes sagae* Beamer.
- 4a. Caudal view of styles and aedeagal brace of *Delphacodes sagae* Beamer.
- 4b. Lateral view of aedeagus, enlarged, of *Delphacodes sagae* Beamer.
5. Lateral view of genital capsule of male of *Delphacodes hyalina* Beamer.
- 5a. Caudal view of styles and aedeagal brace of *Delphacodes hyalina* Beamer.
- 5b. Lateral view of aedeagus, enlarged, of *Delphacodes hyalina* Beamer.

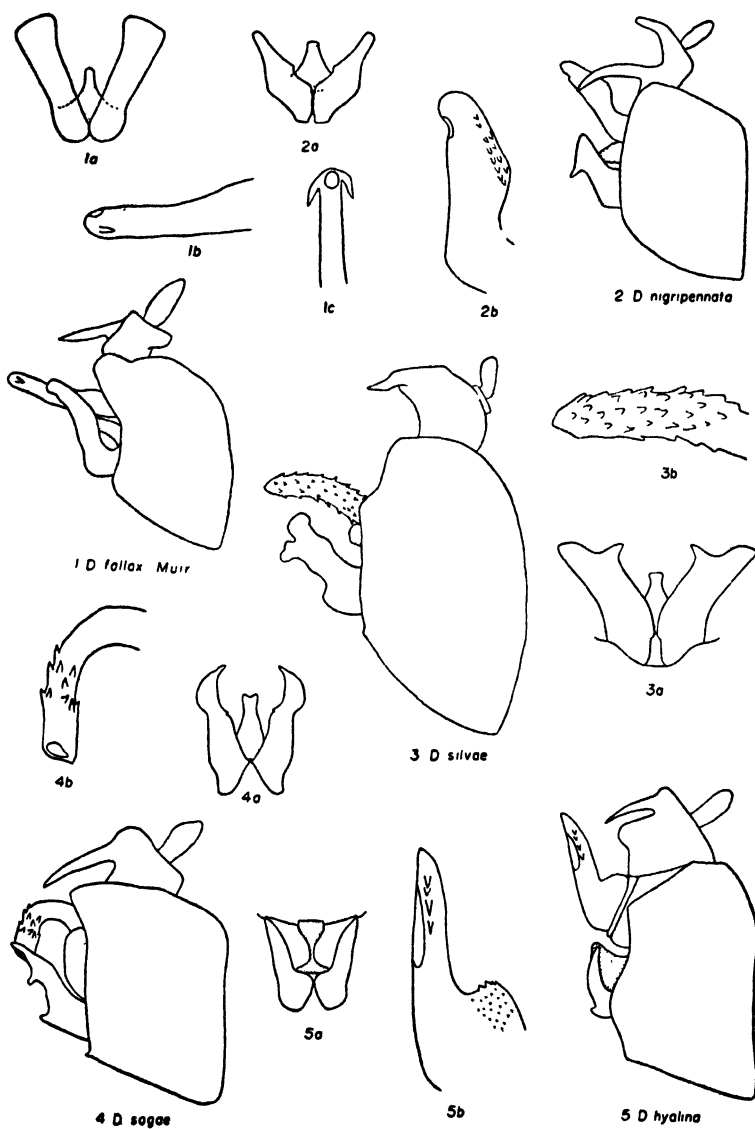


PLATE I

***Delphacodes idonea* n. sp.****Macropterous Form:**

Resembles *Delphacodes wetmorei* M. and G. but much larger, the inturned dorso-caudal portion of pygofer single, about half as wide as same portion in *wetmorei* and aedeagus bent dorsally near base. Length ♂ 3.8 mm.; ♀, 4 mm.

**Structure:** Front slightly more than twice as long as wide, widest near middle, sides converging toward each end, more rapidly toward base, definitely tricarinate, median carina forked near margin of crown; crown definitely longer than basal width, definitely carinate, anterior margin truncate, basal fovea more than twice as wide as long, anterior fovea twice as long as basal width; elytra extending more than one third their length beyond body, gradually widening to beyond crossveins, apices broadly rounded, generally milky hyaline, veins darker.

**Color:** General color stramineous, area between carinae of front, a broad dorsal crossband, portions of sternum and most of ventral surface of abdomen except hind margins of segments, very dark.

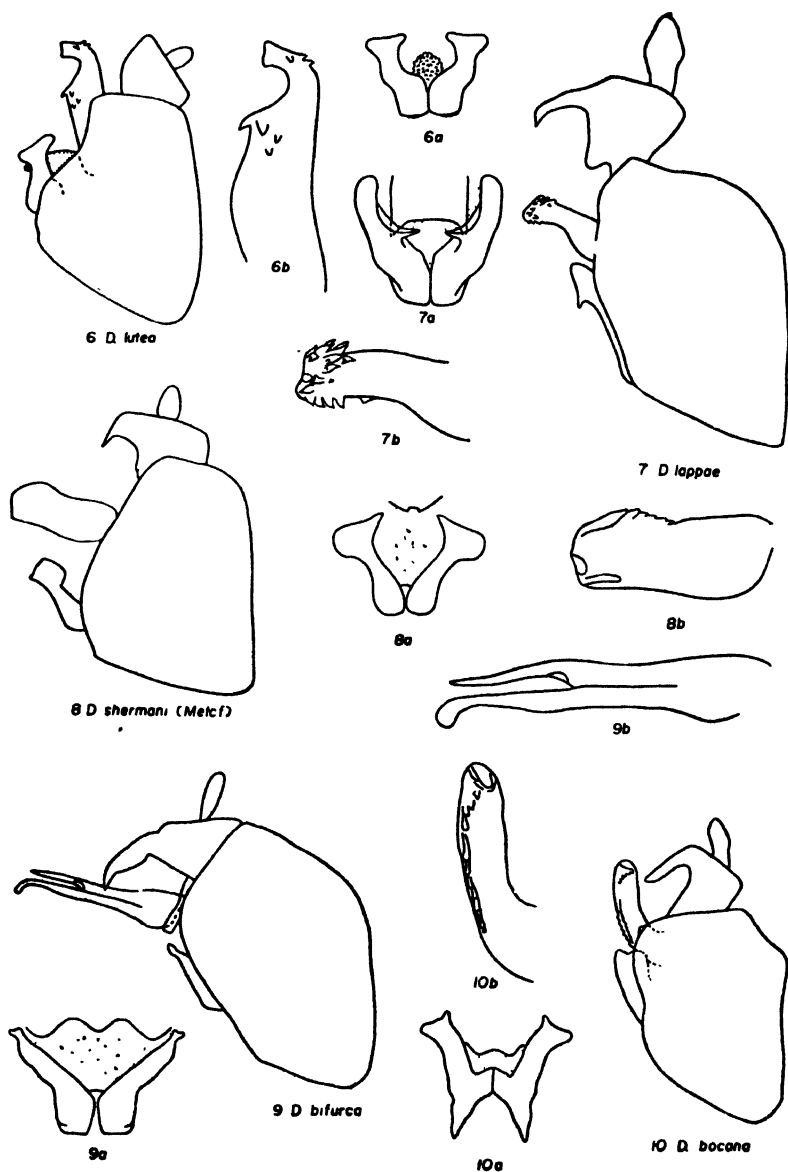
**Genitalia:** In lateral view, pygofer with small caudo-ventral projection; anal segment with a pair of almost straight processes arising near middle closely appressed to segment; aedeagus about twice basal width, bent dorsally near base, median width about one third basal width, slightly enlarged to rounded apices; dorsal margin on outer fourth with about 12 sharp teeth, a row of about 6 teeth angling from dorsal to ventral margin near middle, numerous teeth on ventral margin of basal third, styles with sides almost parallel, slightly bifid at apices, slightly shorter than aedeagus in caudal view, knobbed at base, narrowed toward tips then enlarged at apices on both margins.

Holotype ♂, allotype ♀, 11 ♂ and 7 ♀ paratypes, Homestead, Fla., Aug. 9, 1930, L. D. Tuthill; other paratypes: 8 ♂ ♂ and 6 ♀ ♀; same time and place, R. H. Beamer; 2 ♂ ♂ and 6 ♀ ♀, same time and place, P. W. Oman; 4 ♂ ♂ and 6 ♀ ♀, Cocoanut Grove, Fla., Aug. 9, 1930, P. W. Oman; 15 ♀ ♀, same time and place, J. Nottingham; 1 ♂ and 7 ♀ ♀, same time and place, R. H. Beamer; 3 ♀ ♀, same time and place, L. D. Tuthill; 1 ♂, Morrison Field, West Palm Beach, Fla., Aug. 2, 1942, D. Elmo Hardy.

Types in Snow Entomological Collections.

**Plate II**

6. Lateral view of genital capsule of male of *Delphacodes lutea* Beamer.
- 6a. Caudal view of styles and aedeagal brace of *Delphacodes lutea* Beamer.
- 6b. Lateral view of aedeagus, enlarged, of *Delphacodes lutea* Beamer.
7. Lateral view of genital capsule of male of *Delphacodes lappae* Beamer.
- 7a. Caudal view of styles and aedeagal brace of *Delphacodes lappae* Beamer.
- 7b. Lateral view of aedeagus, enlarged, of *Delphacodes lappae* Beamer.
8. Lateral view of genital capsule of male of *Delphacodes shermani* (Metcalf).
- 8a. Caudal view of styles of *Delphacodes shermani* (Metcalf).
- 8b. Lateral view of aedeagus, enlarged, of *Delphacodes shermani* (Metcalf).
9. Lateral view of genital capsule of male of *Delphacodes bifurca* Beamer.
- 9a. Caudal view of styles and aedeagal brace of *Delphacodes bifurca* Beamer.
- 9b. Lateral view of aedeagus, enlarged, of *Delphacodes bifurca* Beamer.
10. Lateral view of genital capsule of male of *Delphacodes bocana* Beamer.
- 10a. Caudal view of styles and aedeagal brace of *Delphacodes bocana* Beamer.
- 10b. Lateral view of aedeagus, enlarged, of *Delphacodes bocana* Beamer.





***Delphacodes angulata* n. sp.****Brachypterous Form:**

Resembling *Delphacodes caerulea* Beamer but pygofer greatly extended on outer dorsal corner, aedeagus bent dorsally near middle and processes on anal segment bent ventrally on outer half. Length ♂ 2.0 mm.; ♀, 2.5 mm.

**Structure:** Front slightly more than twice as long as wide, widest about middle, definitely narrowed toward base, very slightly narrowed to apex, distinctly but bluntly tricarinate; crown distinctly longer than broad, apex broadly rounded, carinae distinct; elytra broadly oval, reaching to genital capsule in ♂, to fifth segment of abdomen in ♀; hind wings tiny pads, less than one fourth size of eye.

**Color:** General color almost black; venter, except abdomen, front, vertex. pronotum, scutellum, dorsal cross band just before genital capsule in ♂ and anal tube in both sexes, lighter.

**Genitalia:** In lateral view pygofer greatly extended caudally on dorsal margin; anal segment with pair of long, sharp processes arising near middle of ventral margin, bent anteriorly almost at right angles near middle; aedeagus widest at base, bent dorsally near basal third with a diagonal row of about 8 teeth beginning on ventral margin at bend and ending on dorsal margin at beginning of rounded tip; styles widest at base, sinuate, gradually narrowing to a slightly bifid apex, aedeagal brace large, slightly narrowed toward tip, apex slightly concave.

Holotype ♂, allotype ♀, and 4 ♀ paratype, s, Douglas Co., Kansas., April 12, 1946, R. H. Beamer; other paratypes; same place and collector, 4 ♂ ♂ and 1 ♀, April 18, 1946, same place and collector, 1 ♂, July 25, 1945; same place and collector, 8 ♂ ♂, Aug. 17, 1944; Lawrence, Kansas., 19 ♂ ♂, Aug. 23, 1944, R. H. Beamer, same place and collector, 2 ♂ ♂, Sept. 1, 1944; same place and collector, 4 ♂ ♂, Sept. 4, 1944; Welda, Kans., 1 ♂, Sept. 17, 1945, R. H. Beamer; Sterling, Kans., 1 ♂, Aug. 4, 1944, R. H. Beamer; Nickerson, Kans., 1 ♂, Aug. 4, 1945, R. H. Beamer. Medora, Kans., 2 ♂ ♂, Aug. 5, 1945, R. H. Beamer; Aransas Pass, Texas, 2 ♂ ♂, Jan. 2, 1946, R. H. Beamer.

**Macropterous Form:**

Resembling the brachypterous form but with elytra and hind wings ex-

**Plate III**

11. Lateral view of genital capsule of male of *Delphacodes canina* Beamer.
- 11a. Caudal view of styles and aedeagal brace of *Delphacodes canina* Beamer.
- 11b. Lateral view of aedeagus, enlarged, of *Delphacodes canina* Beamer.
12. Lateral view of genital capsule of male of *Delphacodes caerulea* Beamer.
- 12a. Caudal view of styles and aedeagal brace of *Delphacodes caerulea* Beamer.
- 12b. Lateral view of aedeagus, enlarged, of *Delphacodes caerulea* Beamer.
13. Lateral view of genital capsule of male of *Delphacodes peneparvula* Beamer
- 13a. Caudal view of styles and aedeagal brace of *Delphacodes peneparvula* Beamer.
- 13b. Lateral view of aedeagus, enlarged, of *Delphacodes peneparvula* Beamer.
14. Lateral view of genital capsule of male of *Delphacodes perusta* Beamer.
- 14a. Caudal view of styles and aedeagal brace of *Delphacodes perusta* Beamer.
- 14b. Lateral view of aedeagus, enlarged, of *Delphacodes perusta* Beamer.
15. Lateral view of genital capsule of male of *Delphacodes nigriscutellata* Beamer.
- 15a. Caudal view of styles and aedeagal brace of *Delphacodes nigriscutellata* Beamer.
- 15b. Lateral view of aedeagus, enlarged, of *Delphacodes nigriscutellata* Beamer.

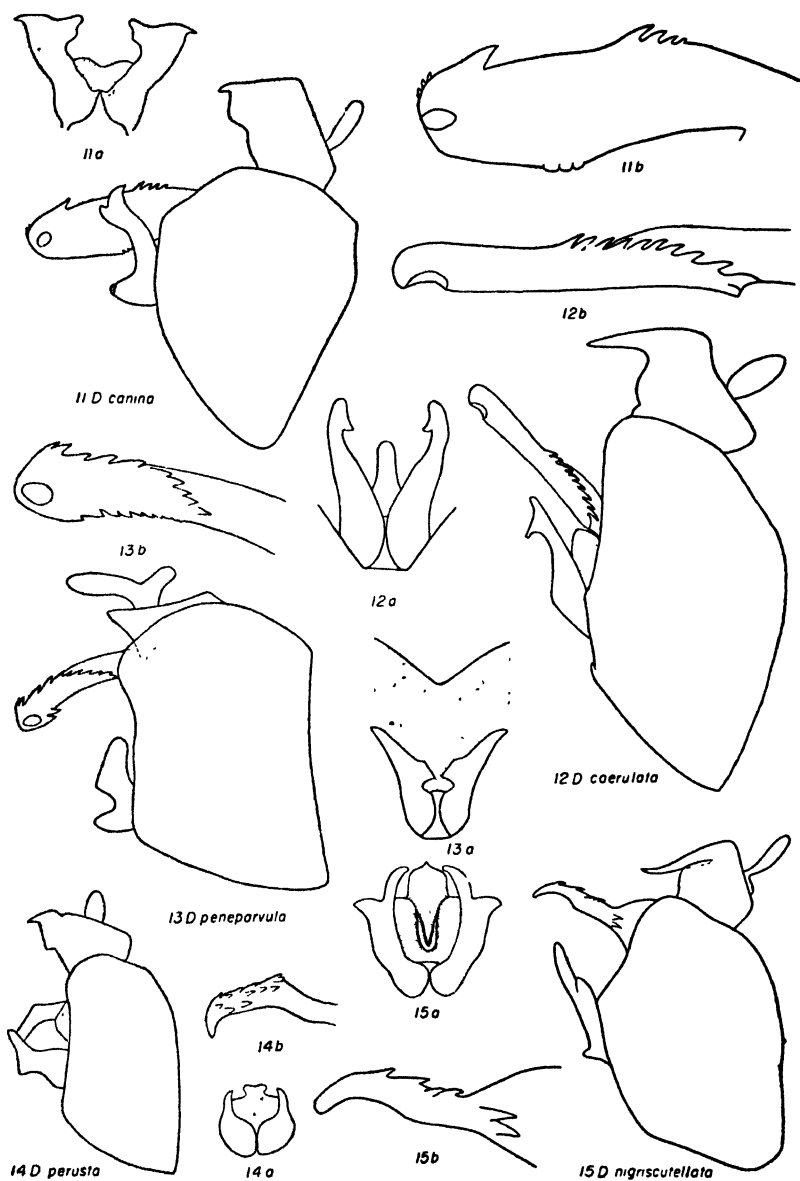


PLATE III

tending almost half their length beyond end of abdomen and general color usually much lighter.

Holomorphotype ♂, allomorphotype ♀, 6 ♂ and 4 ♀ paramorphotypes, Douglas Co., Kans., Aug. 30, 1938, trap light, P. B. Lawson; other paramorphotypes: same place and collector, trap light, 1 ♂, Aug. 28, 1928; Douglas Co., Kans., 1 ♂, Aug. 22, 1945, R. H. Beamer; Lawrence, Kansas., 1 ♂, Sept. 1, 1944, R. H. Beamer; Medora, Kans., S. Hills, 1 ♂, July 6, 1945, R. H. Beamer; Cherokee Co., Kans., 1 ♂, Sept. 19, 1945, R. H. Beamer.

Types in Snow Entomological Collections.

### *Delphacodes pediforma* n. sp.

#### Brachypterous Form:

Resembles *Delphacodes campestris* (V. D.) but larger, anal segment with a pair of long, sharp processes, aedeagus pediform on outer third and styles narrowed at apices. Length ♂ 2.8 mm.; ♀, 3.2 mm.

**Structure:** Front about twice as long as greatest width, widest near middle, narrowing toward both ends, slightly more so toward base, definitely tricarinate; crown longer than wide, not very plainly carinate, elytra with sides almost parallel, apices rounded, reaching almost to genital capsule in ♂ to middle of next to last segment in ♀; hind wings reduced to pads about one third as large as eye.

**Color:** General color stramineous; male with a dark spot above hind and middle coxae and in lateral angles of scutellum, abdomen black except narrow median dorsal longitudinal line, some spots along sides and upper third of genital capsule; female with indications of lateral longitudinal dark stripes on abdomen.

**Genitalia:** In lateral view genital segment with a pair of slender, sharp processes; aedeagus with sides almost parallel on basal three fourths, pediform on outer fourth, heel on dorsal margin, spiny on ventral margin just before foot; styles widest near middle, inner margin sinuate. In caudal view pygofer expanded, sunken; styles widest at base, sharply contracting on outer third; aedeagal brace broad, as long as wide, with apex rounded.

Holotype ♂, allotype ♀, 8 ♂ and 8 ♀ paratypes, Mt. Ranier, Wash., July 6, 1935, R. H. Beamer.

Types in Snow Entomological Collections.

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#### Plate IV

16. Lateral view of genital capsule of male of *Delphacodes atridorsum* Beamer.
- 16a. Caudal view of styles and aedeagal brace of *Delphacodes atridorsum* Beamer.
- 16b. Lateral view of aedeagus, enlarged, of *Delphacodes atridorsum* Beamer.
17. Lateral view of genital capsule of male of *Delphacodes sagitta* Beamer.
- 17a. Caudal view of styles and aedeagal brace of *Delphacodes sagitta* Beamer.
- 17b. Lateral view of aedeagus, enlarged, of *Delphacodes sagitta* Beamer.
- 17c. Ventral view of aedeagus, enlarged, of *Delphacodes sagitta* Beamer.
18. Lateral view of genital capsule of male of *Delphacodes idonea* Beamer.
- 18a. Caudal view of styles and aedeagal brace of *Delphacodes idonea* Beamer.
- 18b. Lateral view of aedeagus, enlarged, of *Delphacodes idonea* Beamer.
19. Lateral view of genital capsule of male of *Delphacodes angulata* Beamer.
- 19a. Caudal view of styles and aedeagal brace of *Delphacodes angulata* Beamer.
- 19b. Lateral view of aedeagus, enlarged, of *Delphacodes angulata* Beamer.
20. Lateral view of genital capsule of male of *Delphacodes pediforma* Beamer.
- 20a. Caudal view of styles and aedeagal brace of *Delphacodes pediforma* Beamer.
- 20b. Lateral view of aedeagus, enlarged, of *Delphacodes pediforma* Beamer.

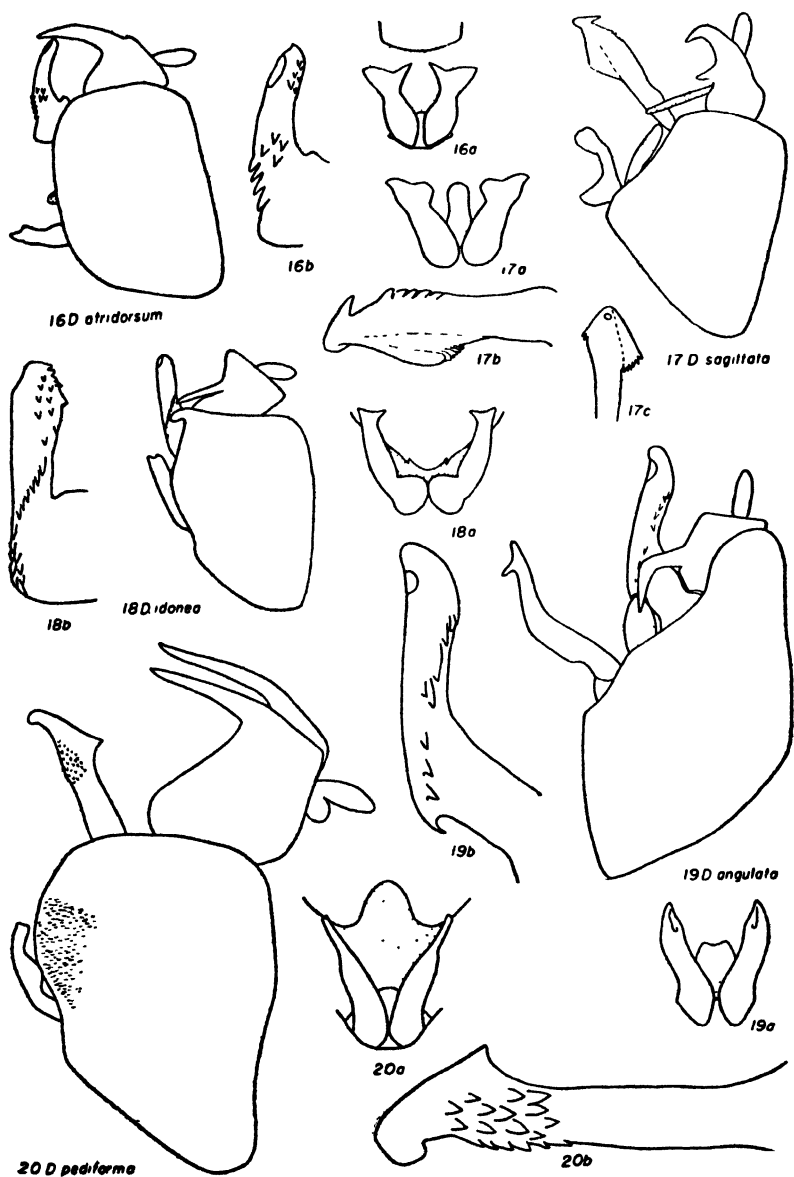


PLATE IV

THE GENUS *LEPTOPTEROMYIA* (ASILIDAE-DIPTERA)

D. ELMO HARDY

Assistant State Entomologist, Ames, Iowa

This genus has been unknown since it was first described by Williston and has existed only by virtue of a brief description and a named figure. Williston<sup>1</sup> described the genus (nomen nudum) but did not mention a species. In his Manual of North American Diptera<sup>2</sup>, he figured *Leptopteromyia gracilis* Will. from Brazil but did not include a description of the species. Aldrich<sup>3</sup> designated this species as the genotype. One year later Hermann<sup>4</sup>, apparently having no knowledge of Aldrich's paper, designated *L. willistoni* Hermann as the genotype. This was merely a designation without a description of a species. It is not known whether Hermann had seen specimens of *Leptopteromyia* from Mexico or whether he just assumed that Williston's species was from there. The writer is unaware of the existence of any description of a *Leptopteromyia* species.

*Leptopteromyia* Williston, 1907, Journ. N. Y. Ent. Soc., 15 1.

The genus is characterized by its unusual wing venation. The wing possesses but four posterior cells instead of the usual five as in most other Leptogastrinae and the anal vein is lacking. The genus appears to be most closely related to *Eurhabdus* Aldrich but the wing base is not so attenuated and vein Cu, and the m-cu crossvein are present (fig 1d). In *Eurhabdus* the wing base is attenuated into a long hair-like stalk, nearly one half as long as the rest of the wing. The subcosta and vein R<sub>1+2</sub> are fused with the costa and the cubital and anal veins as well as the m-cu crossvein, are completely lacking. It differs from *Leptogaster* in having the media but three branched and the anal vein and cell ar<sub>1</sub> lacking. The wing base is much more attenuated than in *Leptogaster* owing to the loss of the anal cell. The halteres are very elongate in *Leptopteromyia*, being equal in length to the thorax. In *Leptogaster* the thorax is one and one half to two times longer than the halteres. The third antennal segment is about one and one half times as long as wide and is rounded apically. The antennae possess slender subdorsal aistae (fig. 1c) instead of the thick two-jointed styli as in *Leptogaster*. In the latter group the third antennal segment is rather slender, tapers to the apex, and is usually three times as long as wide. The style is thick, its base is as wide as the apex of the antenna, and is apical in position.

Hermann<sup>4</sup> did not feel that this genus should be set off from *Leptogaster*. He states that the absence of a posterior cell in the wing is hardly sufficient justification for establishing a genus. In view of the above-mentioned supplementary characters, however, it is obvious that this genus is well defined and is distinct from all other Leptogastrinae.

Genotype: *Leptopteromyia gracilis* Will. from Brazil.

Type apparently lost. Dr. Carrera is designating a neotype from the collection of the Instituto de Experimentacao Agricola de Rio de Janeiro.

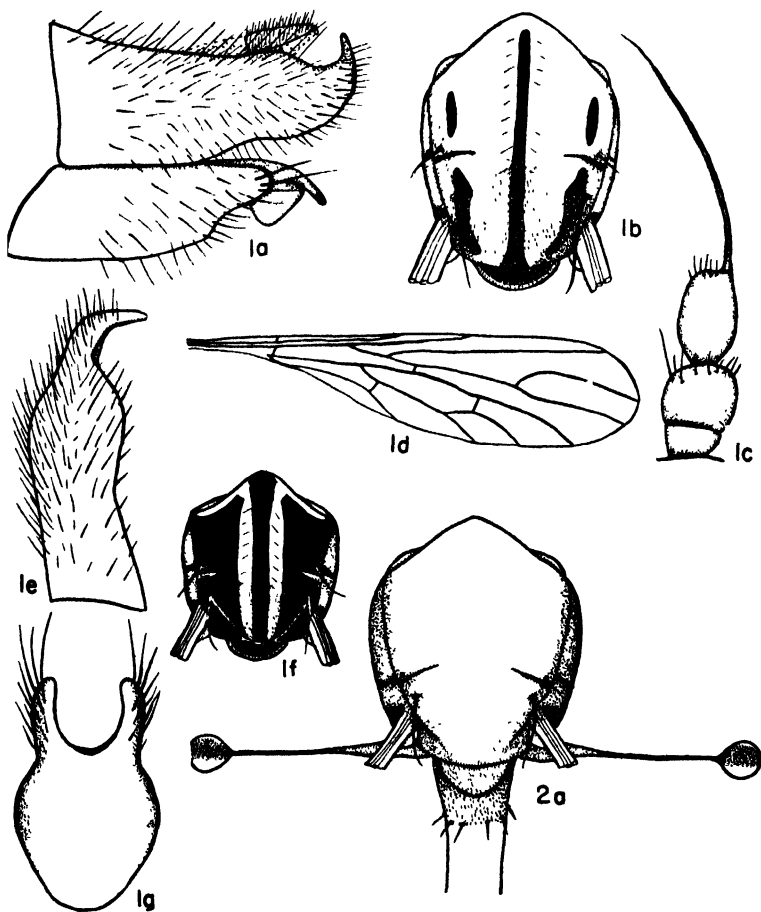
<sup>1</sup>1907, Journ. N. Y. Ent. Soc., 15, p 1.

<sup>2</sup>1908, 3rd Ed., p 195, fig. 35.

<sup>3</sup>1923, Proc. U. S. N. Mus., 62, p. 3.

<sup>4</sup>1924, Verh. der Zool.-Bot. Ges., 74; 143.

Dr. Messias Carrera, of Sao Paulo, recently loaned the writer a specimen from Rio de Janeiro for comparison with the below-described North American species. Carrera is redescribing the genus and *L. gracilis* Williston and is publishing information on the biology of this species. He reports that Dr. Hugo de Souza Lopes found them living on *Embia* (Embioptera) nests. Except



### Explanation of Figures

- Fig. 1. *Leptopteromyia americana* n. sp. a. lateral view of male genitalia; b. thorax of female; c. antenna; d. wing; e. left side of ninth tergum of male; f. thorax of male; g. ninth sternum of male.  
 Fig. 2. *L. gracilis* Williston. a. thorax of female.

for the below-described new species the specimens which Carrera is reporting on are the only known records of the genus since its original description. Hermann may have seen material from Mexico but apparently never published such records.

*Leptopteromyia americana* n. sp.

(Figs. 1a-g)

This species is readily distinguished from the only other known species, *L. gracilis* Will. The third antennal segment is yellowish; not brown to black. The face is two times wider than one eye facet; not extremely narrow and equal in width to one facet. The vertex is broad, in area of ocellar triangle over three times wider than the triangle; not narrow, scarcely wider than the ocellar triangle. The antennae are situated at or slightly below the upper one third of the eye height, from a direct frontal view; not near the upper one fourth of the eye height. The mesonotum is vittate and pubescent in the middle on the posterior third, as in figs. 1b and 1f; not entirely reddish brown and pubescent just on the lateral and hind margins of mesonotum, as in fig. 2a. The stems of halteres are entirely yellow and the knobs are yellow to yellow brown; in *gracilis* the attenuated portions of the stems and the knobs are black. The swollen portion of each hind femora is nearly one half as long as the attenuated basal portion and there are no strong bristles above near apex; in *gracilis* the basal portion is nearly three times longer than the swollen part and there are two strong black bristles above near apex. The hind tibiae of *americana* are strongly swollen toward apices and have only two or three strong bristles above near middles; in *gracilis* the hind tibiae are slender, not greatly swollen and have a row of strong black, bristles above extending from bases to apices. The wing venation is very similar in the two species but the wings of *L. gracilis* are much narrower, more attenuated from humeral crossvein to base. This basal portion is only one fourth as long as the remainder of the wing in *americana*, .7-1.0 mm. long for the base as compared with 2.8-4.0 mm. for the remainder of the wing; in *gracilis* the base is over one third the length of the rest of the wing, 1.5 mm. as compared with 3.7 mm. The abdominal segments of *americana* have broad yellow rings at their apices; the abdominal sclerites of *gracilis* are unicolorous, only the membranous areas between segments are yellow. The specimen of *gracilis* at hand is a female so the male genital structures have not been compared.

The following description is supplemental to the above characters:

**Male. Head:** Face and front silvery pollinose, vertex and occiput more distinctly grayed. Mouthparts and antennae (fig. 1c) yellow. **Thorax:** Chiefly polished brown to black in ground color, with two median yellow vittae. Humeri, front margins of mesonotum and hind margin of scutellum yellow (fig. 1f). Some specimens showed considerable variation in the arrangement of the dorsal vittae. Scutellum, hind part and sides of mesonotum rather thickly whitish pubescent. Dorso-central hairs present but weak. Mesonotum with two strong bristles on each side, one just in front of the

suture and one just before the posterior calli. Thorax scarcely one and one half times as long as the head and equal in length to the elongate halteres. **Legs.** Chiefly yellow, hind femora and tibiae strongly clavate and with broad brown to black rings just before their apices. Apical subsegments of tarsi blackish. Empodia well developed, extending about three fourths the length of the tarsal claws. **Wings:** Venation as in figure 1d. **Abdomen:** Very long, slender, and attenuated, the basal portion not as wide as the enlarged apices of the hind femora. Abdomen chiefly shining black, posterior portion of each segment with a broad yellow ring, posterior portion of abdomen faintly reddish. First segment with a ring of six to eight strong bristles near base, remainder of segments conspicuously clothed with short dark hairs. **Hypopygium:** Yellowish red in color with the apices of ninth tergum blackish. The ninth sternum has a U shaped concavity in middle on hind margin, the apices are produced into a pair of rather slender lobes which bear long bristles (fig. 1g). The ninth tergum is cleft to its base, divided into two lobes, these are strongly curved inwardly and pointed at apices (fig. 1e). **Aedeagus** with very complex accessory structures, which are bilobed, and each has a slender finger-like projection as seen from a lateral view (fig. 1a). Cerci rather elongate, longer than wide. Anal segment well developed. **Length:** Body 6 - 6.6 mm.; wings, 3.6 - 4.0 mm.

**Female:** Very similar to the male except that the mesonotum is chiefly yellow with three black vittae or with the lateral vittae each divided into two elongate spots as in fig. 1b. **Length:** Body, 8.0 - 9.0 mm.; wings, 5.0 - 5.6 mm.

**Holotype male:** Hidalgo, Tex., Dec. 28, 1945. (R.H. Beamer). **Allotype female** and five male and six female paratypes, same data as type, three additional paratypes, one male two females, Brownsville, Tex., June 29, 1938 (R. H. Beamer).

Type, allotype and eight paratypes returned to the Snow Entomological Collections, two presented to the U. S. National Museum, one presented to Dr. S. W. Bromley, one presented to Dr. M. Carrera, and two retained in the Iowa State College Collection.

Dr. Beamer reports that the series of specimens from Hidalgo, Tex., was taken in association with large numbers of Aleyrodidae and that the flies were evidently feeding on these insects.

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# *Journal of the Kansas Entomological Society*

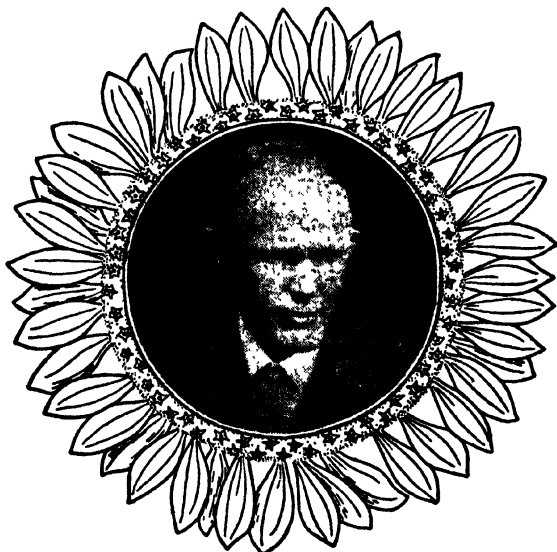
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**Vol. 20, No. 3, July, 1947**

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# Kansas Entomological Society

Volume 20

July, 1947

Number 3

## STUDIES ON THE BIOLOGY OF *TRITOMA SANGUISUGA* (LECONTE) IN KANSAS, (REDUVIIDAE, HEMIPTERA)\*<sup>1</sup>

ALBERT W. GRUNDEMANN

Department of Biology, University of Utah

This is an account of the bionomics of *Triatoma sanguisuga* (LeConte) based upon observations made in connection with studies in Kansas upon the transmission and reservoir of the virus of equine encephalomyelitis. It was discovered by Kitselman and Grundmann (1940) that this insect occurred in a naturally infected condition in the pastures and hillsides about Manhattan, Kansas. In order to more fully understand the relationship of *Triatoma* to this important neurotropic virus disease of man and the horse, and to aid in estimating its importance as reservoir and vector, it was found necessary to acquire additional knowledge concerning the life cycle and habits of this hematophagous species in the area.

Originally described by LeConte (1855) from Georgia and South Carolina, the species ranges as far north as southern Illinois, and from the Atlantic seaboard to Arizona, covering the entire southern part of the United States. It is also found in Mexico along the western seaboard to the latitude of the tip of lower California. A complete record of its range is reported by Usinger (1944).

Early references to the biology of *T. sanguisuga* are mostly in regard to its bloodsucking habits. LeConte (1855) reported that the insect could inflict a painful bite and was remarkable because it sucked the blood of mammals, preferring children in particular. Walsh and Riley (1869) also gained evidence that the insect was a seeker of human blood. Kimball (1894) stated that the insect was often found in her home and that it had increased in such numbers in the region of Manhattan, Kansas, that it was considered a common insect. She also observed the adults flying into stables and hen houses and feeding upon horses and chickens. Readio (1927) has summarized published work prior to his publication and reports Morrill as stating that in many parts of Arizona, *Triatoma* species have taken the place of the common bedbug as a household pest. More recent notes upon the distribution and habits may be found in publications by Wood (1940) and Usinger (1944).

Within the last few years, this species has been shown to be a potential menace to health. In addition to being naturally infected with western

\*Contribution No. 550 from the Department of Entomology, Kansas State College.

<sup>1</sup>This paper is an outgrowth of a study of the relationship of arthropods to equine encephalomyelitis at Kansas State College, which was financed in part by a grant from the Horse and Mule Association of America. The facilities of the School of Veterinary Medicine and of the Department of Entomology of the Kansas State College of Agriculture and Applied Science were used in this study. The project was conducted under the supervision of Dr. Roger C. Smith, head, Department of Entomology, Dr. L. M. Roderick, head, Department of Veterinary Pathology, and Dr. C. H. Kitselman, Pathologist, Kansas Agricultural Experiment Station.

strain equine encephalomyelitis, it has been reported to be naturally infected with *Trypanosoma cruzi* of Chagas Disease as reported by Davis, McGregor and de Shazo (1943).

### APPARATUS AND TECHNIQUE

Apparatus was developed for two purposes: First, to maintain cultures of the insect in the laboratory, and second, to maintain individual insects for life cycle observations. The apparatus developed for the first purpose consisted of two cages, a smaller one placed inside a larger. The larger cage was 18x18x24 inches and was constructed of wood and screen with one side removable as a tight fitting door. The inner, and smaller, cage containing the host animal used to provide blood for the colony was made up of two office letter baskets wired together hinge-fashion at one side with a wire fastening on the other side. The animal cage was held above the floor of the larger cage by being placed upon blocks of wood. Paper toweling placed beneath the animal cage caught the feces and absorbed the urine. In an attempt to simulate natural conditions, trash of various types, such as paper, sticks, stones etc., was placed in the outer cage to provide concealment for the specimens. The cages were kept darkened and a guinea pig or wood rat was placed in the inner cage overnight once every five days to provide the necessary blood. Moisture was provided by placing a moist piece of absorbent cotton in the cages daily.

Small ant cages and large vials served as containers used in the second or life cycle experiments. The ant cages obtained from Ward's Biological Supply were very good as they have a darkened section with excellent possibilities of observations. When vials were used, strips of paper toweling were included to give the insects something upon which to cling and to absorb excreta. Small pledgets of cotton were moistened daily and placed in the vials, since it was found that in case moisture was insufficient, molting would not be normal and the insect would be unable to cast completely the exuviae which usually proved fatal. Individual specimens were placed in contact with an animal overnight in the apparatus described for maintaining cultures in the laboratory.

When insects were fed upon horses, a screen cage was used which could be fastened to the shaven side of the animal with adhesive tape. Four or five specimens of different instars were allowed to feed at the same time. When monkeys were used, a cage was constructed which contained a false bottom. The specimens to be fed were placed in the bottom section which contained holes one-half inch in diameter to allow the specimens access to the cage containing the monkey.

The principal animals used for feeding purposes in the laboratory were guinea pigs and wood rats. In addition, horses and a rhesus monkey were used in a number of trials. Insects fed upon the blood of one animal did not hesitate to engorge when placed upon an animal of a different species for the next feeding, nor did the blood of the various species in subsequent feedings appear to affect development.

## FIELD OBSERVATIONS

The natural host of *T. sanguisuga* in the region of Manhattan was found to be the wood rat, *Neotoma floridana baileyi* Merriam, and it was from the nests of this species that the majority of the specimens collected were taken. On several occasions, specimens were also taken from the nests of the western cotton rat, *Sigmodon hispidus texianus* (Audubon and Backman). The insect also feeds upon other animals in its environment, since a few of the specimens were collected at a distance from rodent burrows. On one occasion, three nymphs examined for virus were found to be engorged with a clear yellowish fluid resembling blood serum, possibly insect blood.

The wood rat host was found to build its burrows beneath the flat stones along the limestone outcrops protruding from many of the hillside pastures of eastern Kansas and abundant in the area about Manhattan. Outcrops near bushy and woody areas were found to be preferred by the rats since these localities provide more abundant food than the open grassy areas. In the valley bottoms, especially wooded sections where suitable stones were absent, the rat nests were built of detritus and sticks. Few of the latter type nests were found that were not built within a bush or about the base of a small tree, since some supporting structure is needed to keep the nest from easily being disturbed. Nests were also found in wood piles on the farms.

Most of the specimens taken were collected from nests built beneath loose stones along the limestone outcrops. These nests could be easily located by the sticks and detritus which the rats pile on top of the overlying stone and about the entrance to the nest beneath the stone. When the overlying stone was overturned, adults and nymphs could be found clinging to the underside or in the cracks and crevices of the stone, and in the detritus and small rocks within a yard of the inner nest of the rat. The insects apparently select resting positions that are well protected from the host.

The nests most commonly selected by the insects were those providing a more or less constant micro-climate and remaining dry throughout the year. The nests most heavily parasitized were those in which the overlying rock was found to rest upon a series of broken rock or talus as in an eroded bedding plane. This type provides a multitude of dry cracks and crevices into which the *Triatoma* could retreat while digesting their meals. Stones allowing water to drain beneath them during wet weather or embedded in the soil of the hillside were not selected by either the rats or the insects.

When the flat, overlying stones were overturned, many of the insects could be found clinging to the underside. The position, with the ventral side uppermost, seems to be preferred while the insects are digesting their meals. It was also prevalent in the laboratory colonies where they could hang on the underside of the animal cage, and other detritus provided for their concealment. The nymphs appear to be negatively phototropic at all times. The adults, become positively phototropic soon after molting and may be collected about lights in the vicinity. After fertilization, the adults find a host and do not use their wings again.



The insects were found to hibernate during the cold portions of the year. There is no diapause, since field observation showed them to become sluggishly active during warm winter days. Some nymphs appeared to overwinter in a partially engorged condition. During hibernation the insects assume a dorso-ventral position.

The results of the collections of *T. sanguisuga* are summarized in Table I. Specimens were sent to H. G. Barbour of the Bureau of Insect Identification and to Dr. A. Packchanian of the United States Public Health Service for verification, and to the latter for examination for infection with *Trypanosoma cruzi*. A total of 375 specimens were collected during the sur-

Table I. Summary of *Triatoma sanguisuga* collected for experimental purposes in the vicinity of Manhattan, Kansas, from May, 1940 to November, 1941.

	Instar.												
Date	1	2	3	4	5	6	7	8	M	F	*	**	
May 12, 1940	....	....	....	....	4	1	4	....	2	3	14	28	
May 28, 1940	....	....	....	2	....	5	7	....	2	2	17	28	
June 11, 1940	....	....	....	4	5	....	3	3	1	3	19	26.3	
June 21, 1940	....	....	....	....	....	3	4	....	3	4	14	28.5	
June 28, 1940	....	2	1	4	3	1	3	....	....	1	15	40	
Aug. 10, 1940	....	3	4	....	....	....	....	5	2	4	18	22.2	
Nov. 29, 1940	....	....	1	1	1	1	8	....	2	....	14	14.2	
Jan. 11, 1941	....	2	4	6	4	3	4	2	....	....	25	4	
Feb. 17, 1941	....	....	....	....	....	....	....	1	1	1	3	0	
Mar. 11, 1941	....	....	....	....	....	....	....	....	....	....	0	0	
Apr. 10, 1941	....	....	....	1	....	....	1	....	....	....	2	0	
Apr. 11, 1941	....	....	....	....	....	....	....	....	1	....	1	0	
Apr. 12, 1941	....	....	1	....	1	....	....	....	....	....	2	0	
Apr. 17, 1941	....	....	....	1	....	....	....	1	....	....	2	0	
Apr. 22, 1941	....	3	4	1	....	1	2	....	....	....	11	20	
Apr. 24, 1941	....	3	3	1	4	4	2	6	....	....	23	43.4	
May 6, 1941	....	2	1	....	....	1	2	....	....	....	6	16.6	
May 8, 1941	....	1	2	3	3	5	5	2	....	....	21	38	
May 13, 1941	....	6	4	5	4	7	9	7	1	1	44	47.7	
June 5, 1941	2	6	3	3	2	4	3	4	1	3	31	37	
July 8, 1941	1	....	3	2	5	1	....	3	1	2	18	22	
Sept. 11, 1941	1	5	4	3	3	3	5	7	1	3	35	18.1	
Oct. 13, 1941	1	5	4	1	1	5	3	1	1	....	22	14.2	
Nov. 11, 1941	....	8	2	1	....	2	....	3	....	....	18	16.6	
Totals	5	46	41	39	40	47	65	45	19	27	375	—	

\*Total number insects collected.

\*\*Percent naturally engorged.

vey, which covered a period of eighteen months. A more or less equal distribution was noted among the various instars, with the exception of the first instar, a number of which were probably overlooked, and the adults, some of which had migrated previously.

Some wood rat nests were very heavily infested while some were entirely free from parasites. One nest investigated contained 23 *Triatoma* of various instars, 77 *Ornithodoros turicata* Duges and seven fleas, *Epidemia wenmanni* (Roths).

### LABORATORY OBSERVATIONS

**Life Cycle Studies.** The egg of *T. sanguisuga* is about 1.5 mm. in length, oval, and pearly-white in color. There is an operculum at one end which is forced off during eclosion. The embryo is encased in its embryonic membrane, from which it emerges, leaving the membrane attached to the shell. The eggs are deposited singly and indiscriminately without apparent regard for micro-climate. There is no adhesive material to fasten them to a surface. In nature, the eggs, are deposited while the female is quiescently digesting the blood meal.

Temperature was found to have an effect upon both oviposition and embryonic development. One to three eggs were deposited daily when the mean daily temperature was below 80 degrees F. and three to five daily when above. Embryonic development was accelerated by increased temperatures and retarded by lowered temperatures. Eggs were found to hatch in 13 to 32 days when the mean daily temperature was 80 degrees F. in May and early June, and 13 to 23 days during July and August when mean temperatures were above 80 degrees. Humidity apparently has little effect upon the speed of development or upon oviposition. This corroborates the results obtained by Clark (1935) who demonstrated that low temperatures retard and high temperatures accelerate development in *Rhodnius prolixus* Stal., a closely related species, while a normal humidity range has little effect.

Upon dissecting newly-molted females, it was found that seven to fifteen eggs are matured in the ovarioles. These are normally not deposited until the female has been fertilized and obtained a blood meal. Oviposition began four to six days following a blood meal and one to five eggs were deposited daily, depending upon the temperature, until the ovarioles were empty. The female then matures a second group which are not deposited normally until after the next blood meal. In several cases observed, females that were prevented from fertilization retained the initial group of eggs in the body until death.

From six to eight days prior to hatching, the egg turns pinkish, the color becoming more intense the closer the embryo approaches eclosion. This color change apparently is caused by the chorion which allows the embryo color to show through.

In nature the eggs are laid beginning in May and ceasing about the middle of September.

**Fertilization and Blood Meals.** The newly-molted adults migrate from the wood rat nests for fertilization. They become positively phototropic at this time, use their wings, and may be collected about lights in nearby areas. One fertilization apparently lasts the female throughout her life. Once the female has been fertilized, she finds a host, engorges, and begins the establishment of a colony.

During the 24 hour period following engorgement, *T. sanguisuga* eliminates a considerable quantity of liquid fecal material. This initial elimination consists of the excess water taken in with the engorged blood, and the residue of metabolism remaining in the Malpighian tubules from the last engorgement. Later excretions consist of a meconium of darker material which contains considerable quantities of hemoglobin and very little moisture. At the completion of engorgement, the insects were observed to defecate the contents of the fecal pouch, a function characteristic of the genus. The above observations are similar to those of Wigglesworth (1931) in his studies of *Rhodnius prolixus* Stal.

**Hosts.** The female, following fertilization, seeks a meal of blood from some source, preferably a mammal. In most cases, it enters the burrows of its normal host which in this region was found to be a wood rat, *Neotoma floridana baileyi* Merriam. The species is by no means host specific, either in the laboratory or in the field; specimens were observed to enter stables and feed upon horses and chickens, and go into homes where in several cases both nymphs and adults were taken engorged from the beds of inmates. In the field, they were taken from the burrows of the western cotton rat, *Sigmodon hispidus texianus* (Audubon and Backman), and in all probability feed upon other rodents and animals present in the environment. In the laboratory there was no difficulty in obtaining feedings upon guinea pigs, horses and mules, the rhesus monkey, and man.

**The Nymphal Instars.** Through laboratory rearing and by measurement of the head capsules of nymphs, *T. sanguisuga* was found to have eight nymphal instars. The overall size of the insect proved to be a very poor criterion for determining the instar, since the abdomens may be in various stages of distension with blood and distort the proportions. A more satisfactory means of determining the instar was through the measurement of the head capsule immediately posterior to the eyes. Measurement of the head capsules of dried specimens showed that the increment of size was approximately 0.1 mm. per instar. Results of the measurement appear in the following table.

**Length of the Life Cycle.** The life cycle was found to be about 450 days in laboratory rearings. Estimates of the length of the cycle in nature were made upon the basis of the average length of instar, the length of adult life, and the length of the active season in this region. These cycles were calculated to be considerably longer than the cycle in the laboratory which makes no allowance for seasonal activity.

The average length of instars in laboratory (and seasonal rearing) was found to be approximately 41 days. No appreciable difference in length

Table II Width of the head capsule of dried specimens in millimeters

Instar	Greatest	Least	Averages
First.....	0.431	0.425	0.428
Second.....	0.536	0.534	0.535
Third.....	0.653	0.620	0.642
Fourth.....	0.750	0.719	0.738
Fifth.....	0.872	0.856	0.864
Sixth.....	0.963	0.948	0.956
Seventh.....	1.071	1.071	1.071
Eighth.....	1.193	1.147	1.168
Adult.....	1.078	1.068	1.071

of instar was noted between the earlier instars and the later ones. Seventy-five per cent of the nymphs molted following a single engorgement and are designated as Group I. The remainder, except two, molted following two engorgements and are designated as Group II. These engorgements were made in the apparatus described previously for maintaining the colonies in the laboratory and approached natural conditions where the insects have access to an animal that is capable of movement. The insects that failed to molt following a single engorgement are considered to be those that were disturbed during feeding, thereby not becoming fully engorged; since full engorgement is considered necessary to stimulate the molting hormones, (Wigglesworth, 1933), this group failed to molt and so required a second engorgement.

Group I averaged 36 days as the length of instar. During May and June, the average time was 40 days. When mean daily temperatures were higher during July and August, the period was shortened to 28 days. The average time between feedings in Group II was found to be 29 days during May and June and 26 days during July and August, with an average of 55 days between molts. Thus compiling the figures for both groups would give an average length of instar of 41 days.

The adults of *T. sanguisuga* are long lived. Wood (1941) reported that a female of this species lived 155 days on four feedings. In the present observations a female lived 81 days on three feedings of guinea pig blood, and another lived 102 days on three feedings. Last instar nymphs were found to molt to adults at Manhattan from May 1 to about October 15. Those molting late in the season appeared to remain in the nests until the following spring and constituted a portion of the adults found in the nests during the winter. Other adults, being long-lived, lived over from one season to the next.

The active season in the region of Manhattan appeared to be between 200 and 235 days per year, or from about March 15 to November 15. Although the insects may be active after March 15, they apparently do not engorge until about April 15, as shown in Table I. In a normal year it is doubtful if any engorgement takes place after October 30, though on

warm days the temperature may be high enough; but at night the temperatures would be such as to inactivate the insects. The season during which molting takes place is estimated as approximately 200 days.

The life cycle estimate of 450 days in the laboratory depends upon the availability of hosts and the relatively constant temperatures which do not occur in nature. In favorable seasons, four to five instars may occur each season. All instars except the first may be found in the wood rat nests at any time of the year, as may be seen by reference to Table I. Since the females lay eggs at intervals throughout their lives, a great complexity in nest composition becomes inevitable. Thus, a first instar arising in May when the first series of eggs are hatched would undergo three instars the first summer, over-winter as a third instar nymph, pass four or five instars the second summer, and over-winter as an eighth instar nymph. This individual would molt to an adult in the spring and pass the third season as adult, and might even pass the third winter in the adult stage. The life cycle as based upon this example would cover approximately three years, making the *Triatoma* an excellent reservoir for infection.

**Sex Ratio.** Field collections, as shown in Table I, show that approximately 41 per cent of all adults collected were males, while the laboratory rearings of 16 eighth-instar nymphs to adults gave approximately 32 per cent males. On the basis of collections and rearings, it is evident that there are more females than males, but the exact ratio has not been determined.

**Feeding Observations.** *Triatoma* when hungry were found to feed readily upon mammals of several species. To check the details of engorgement, the author allowed a number of laboratory-reared *Triatoma* to feed upon the back of the hand. The bite of the insect was found to be somewhat anesthetic, since the host does not become disturbed during the feeding process lasting from three to eight minutes. The only indication of the presence of the insect was a slight tickling sensation when the proboscis was first introduced, and no reaction followed the bites. However, severe reactions have been observed and reported from several individuals sensitive to the bites of this species.

Feedings occurs only during the dark hours of the day or under darkened conditions. Insects were fed upon horses between the hours of 8 and 10 p.m. They were left in contact with the animal for a period of 20 minutes in a specially prepared screen cage that was taped to the side of the animal. Those insects in a physiological state of hunger fed readily, and those not in this condition could not be induced to feed under any conditions.

## SUMMARY

1. *T. sanguisuga* was calculated to have a life cycle of approximately three years under natural conditions in Kansas, with eight nymphal instars and an adult stage.

2. The natural host in this region was found to be the wood rat *Neotoma floridana baileyi* Merriam, which is the common wood rat of the region

found in the pastures along the hillsides. The western cotton rat, *Sigmodon hispidus texianus* (Audubon and Backman) serves as an occasional host. So do other animals living in the environment.

3. The adult female is long-lived and lays a group of eggs following each blood meal. Temperature affects the development of the insect and of its eggs, in that high temperature accelerates and low temperature retards the development. Humidity does not appear to affect the development except as regards molting, and high humidity is generally avoided by the insect in its normal environment.

4. The life cycle of three years duration could make the insect important as a reservoir host of equine encephalomyelitis virus; coupled with the fact that the insect will feed upon almost any animal, this could make it one of the important factors in the maintenance of the disease among rodents and wildlife in the region of eastern Kansas.

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INJURY TO RASPBERRY BY A MEADOW GRASSHOPPER<sup>1</sup>

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An unusual type of insect injury was observed in a small planting of raspberries near Fayetteville in the fall of 1945. The damage resulted from oviposition in the canes by a meadow grasshopper, *Orchelimum vulgare* Harris.<sup>2</sup> There is no previous record of such injury to raspberry in Arkansas although it has been noted elsewhere in several instances. A detailed account of damage by this species in Illinois is given by Metcalf and Colby (3).

The procedure followed by the ovipositing female was observed many times. Briefly, a cane is grasped firmly by the first and second pairs of legs; the insect then repeatedly grips the cane with the mandibles, tugging first in one direction and then the other, until the bark is well splintered over an area about one-fourth inch in diameter. The ovipositor is then inserted through the wound into the pith, where an egg is deposited. Additional eggs are commonly deposited in the same site after further splintering. Ordinarily a lengthy series of these scars is made, spaced about half an inch apart on the cane. Metcalf and Colby (3) apparently observed the insertion of the ovipositor to precede the splintering procedure. Present observations indicate that the splintering occurs first and serves the purpose of preparing an entrance into the pith for the ovipositor. Hancock (1) also describes the splintering as preceding egg deposition in the case of *Orchelimum glaberrimum*, a species with similar habits.

The crop loss comes about when these weakened canes break as a result of wind, rain or snow. In the present case the loss would have been serious had the planting been of commercial extent. It was not unusual for half the canes on a plant to be affected.

Similar injury, probably by the same species, was found widely distributed on a large number of plant species. In no case other than raspberry was the damage of economic importance. Plants showing typical injury were as follows:

Field corn.....	<i>Zea mays</i> L.
Sweet corn.....	<i>Zea mays</i> L.
Johnson grass.....	<i>Sorghum halepense</i> (L.) Pers.
Lamb's quarter.....	<i>Chenopodium album</i> L.
Red raspberry.....	<i>Rubus idaeus</i> L.
Wild blackberry.....	<i>Rubus</i> sp.
Cultivated rose.....	<i>Rosa</i> sp.
Wild carrot.....	<i>Daucus carota</i> L.
Horse nettle.....	<i>Solanum carolinense</i> L.
Giant ragweed.....	<i>Ambrosia trifida</i> L.

<sup>1</sup> Research Paper No. 825 Journal Series, University of Arkansas. Published with the permission of the Director of the Arkansas Agricultural Experiment Station.

<sup>2</sup> Order Orthoptera, family Tettigonidae.

Cocklebur.....	<i>Xanthium pensylvanicum</i> Wallr.
Chrysanthemum.....	<i>Chrysanthemum</i> sp.
Thistle.....	<i>Cirsium lanceolatum</i> (L.) Hill
Wild lettuce (two species).....	<i>Lactuca</i> spp.

Injury to several other plant species is reported by Metcalf and Colby (3). Riley (5) notes injury to sorghum heads in Arkansas.

The oviposition scars might be confused with those made by cicadas, which are known to oviposit in low-growing plants. Newell (4) and Isely (2) have reported instances of cicada oviposition injury to cotton and other herbaceous plants. Apparently the two types of injury can be distinguished by the arrangement of splinters. In cicada oviposition scars the splinters tend to point in one direction. In meadow grasshopper injury the splinters are broken in the middle, and therefore point in two general directions.

Seasonal history notes indicate that this meadow grasshopper requires nearly the entire growing season to reach maturity and deposit eggs. A large bundle of corn tassels containing eggs in the main stem was placed in an outdoor cage for observation through the winter and spring of 1945-46. Hatching began on May 6, 1946. The cage was not maintained through the summer, but adults in the field were first noted in mid-August. Very little injury from this brood was seen. During the previous year, injury was first noticed October 8. New injury appeared for several weeks thereafter, or until cold weather arrived.

No control measures were attempted. It appears, however, that several measures suggested by Metcalf and Colby (3) might prove beneficial. Their observations indicate that leguminous crops are preferred for food and that injury is more severe where legumes are adjacent to raspberry plantings. Separation of these crops should therefore reduce injury. Destruction of infested canes apparently gave good results in Illinois. Since eggs are deposited in many species of weeds it is probable that clean cultivation and winter clean-up of fence-rows and weed patches would be beneficial.

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## AN UNUSUAL WEATHER SEQUENCE ACCOMPANYING THE SEVERE POTATO PSYLLID OUTBREAK OF 1938 IN NEBRASKA<sup>1</sup>

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A study of the summer weather records for Scottsbluff, Nebraska, covering the 26-year period from 1921 through 1946 has revealed some interesting facts not previously reported regarding the relationship of weather to the occurrence and abundance of the potato psyllid, *Paratrioza cockerelli* (Sulc). Entomologists, potato growers, and others closely connected with potato production in western Nebraska have believed for several years that cool weather or the absence of high temperatures in July is a necessary prerequisite for the development of large psyllid populations. However, the extremely severe psyllid outbreak of 1938 was accompanied in this area by an unusual weather sequence. It is true that July of that year was cool, but the season was extraordinary in that July was also wet, followed by an exceptionally warm August and September. It is the purpose of this paper to show how such weather would provide ideal conditions for psyllid development under the cropping system practiced in the North Platte Valley. Although the present discussion is based on data from one locality, the relationship observed here most likely exists in certain other northern areas where populations of this psyllid only occasionally become large enough to cause serious trouble.

### Review of Literature

Psyllid yellows, a disease produced by the feeding activities of the nymphs of the potato psyllid, caused an estimated loss of 25 per cent (more than one million bushels) of the western Nebraska commercial potato crop in 1938. Additional damage in the form of early sprouting and spoilage of tubers in storage also resulted (1). Although the relationship of the psyllid to the diseased condition was unknown previous to 1927, field notes by Werner (8) indicate that this pest may have been responsible for occasional losses in this area, at least since 1922. In 1922 he reported "abnormal plants were causing concern to a serious extent." However, psyllid-yellows disease was far more serious and caused greater losses in Nebraska during 1938 than in any previous or subsequent season (3). According to Werner (8), psyllids were prevalent all over the state early in the summer of 1938 and in western Nebraska they had become "extremely abundant by mid-September."

The detrimental effects of high summer temperatures on psyllid abundance have been noted by several individuals (2, 4, 5, 6, 7, 8). Hartman (2) has shown from field observations in Wyoming that psyllid damage is lessened by high summer temperatures. Laboratory studies made by List (4) indicate "that the species thrives best at about 80 degrees . . . . Oviposition, hatching and survival are definitely reduced under 90 degrees constant temperature, while a temperature of 95 degrees for only two or three hours per day permits

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little, if any, increase in numbers. One hundred degrees for one or two hours of the day are very definitely lethal to eggs and nymphs and practically stop all egg laying." Werner's (8) study of weather data from various localities in western Nebraska indicated that "psyllids have been most abundant in cool years and least abundant in years with many hot days." On the basis of field studies, Wallis (5 and 6) correlated the seasonal fluctuation in psyllid population in western Nebraska during 1939 and 1940 with the maximum temperatures. He found that as the average maximum temperature reached a high level in July, the psyllid population dropped only to increase again during August and September with the return of cooler weather. In a recent paper Wallis (7), discussing the seasonal occurrence of psyllids, states "populations generally built up on early potatoes which reached their maximum growth in July. This fact indicates that large plants protect psyllids from high air temperature." He further noted that "High temperatures apparently have little retarding influence on the development of psyllid infestations in August, . . ."

#### **Comparison of the Weather Data**

With the exception of 1922, the summer weather of 1938 differed markedly from all others of the 26-year period (1921-1946). The rainfall in July, 1938, was high, the total being 2.54 inches as compared to 1.33 for the average. In only three other seasons, namely, 1922, 1923, and 1928 was the precipitation for that month greater. Although the mean July temperature was barely below average for the period, on only three days did the maximum temperature attain or exceed 95 degrees during the first two-thirds of the month. July in only three other years had fewer such hot days during the first 20 days.

August of 1938 was dry and exceptionally warm. Only once during the 26-year period was the average temperature higher. On fourteen days the temperature attained or exceeded 95 degrees and this in other years was equalled only once and surpassed but twice. Furthermore, there were six days in August, 1938, when temperatures of 100 degrees or higher occurred. The nearest approach to this record was August, 1936, when four such days were recorded. For the 26-year period the average number of days during August when temperatures reached 100 degrees or more is but 1.2 days.

September likewise was warm. The mean monthly temperature was 65.4 degrees which, except for 1931 when the mean also was 65.4, is the highest for the entire period. Also the average minimum temperature was higher in 1938 than for any other September during the 26-year period.

Pertinent weather data for the interval 1938 to 1946, along with averages for the 26-year period (1921-1946), are given in Table 1.

#### **Discussion**

No actual psyllid population records are available for 1938, but tremendously large numbers must have been present. Not only was serious damage experienced in Nebraska but psyllid injury was reported from Colorado, Wyoming, Montana, and even Canada. A series of favorable conditions involving weather, host plants, and insects apparently coincided

over a large portion of the range of the species to produce that outbreak. In 1939 the psyllid infestation in Nebraska was low (5). Since that time fluctuations have occurred from year to year with numbers present one season having no noticeable influence on the population the following year. Apparently the insect does not hibernate in this area (7).

In Scotts Bluff County there have been in the past essentially two potato crops: an early crop (at present representing only a small percentage of total potato acreage) is planted in April and early May and harvested in late July and early August; the principal or late crop is planted in June and harvested late in September and early October.

Available evidence indicates that in western Nebraska the "critical period" (when hot days are most effective in reducing psyllid populations) extends from about June 21 to July 20 (5, 6, 8). During this interval, vines in late fields are only emerging and becoming established. Hot days then are especially effective in preventing the establishment of a destructive psyllid infestation in late fields. The small plants afford little protection, and high temperatures at that time are lethal to the eggs and young nymphs.

The situation in the early-planted fields is entirely different. Wallis (5) found that temperatures within the large plants may be 15 to 20 degrees below that of the surrounding air on hot July days. Psyllids are thus protected from the heat and the populations continue to increase in early-planted fields (Table 2). It seems apparent, therefore, that as potato vines in late-planted fields become larger and the foliage more dense, the adverse effect of high summer temperatures on psyllid development is reduced. In fact, the high temperatures that would be detrimental earlier in the season become beneficial to the psyllid in that they prevent the temperature around the base of the plant from becoming too low for optimum development. Thus the unusually warm August and September of 1938 most likely accounted for the great psyllid population increase on the late crop and the resultant heavy damage. Such conditions not only permitted the psyllids to develop normally, but the lengthened season extended the breeding period. An examination of conditions prevailing during 1941 and 1942 supports this view.

In both 1941 and 1942, psyllids appeared early and rather abundantly on volunteer potato plants, cull dumps, early-planted potatoes and certain spring hosts. Although in each of these seasons July averaged cooler than in 1938, in 1941 there were eleven and in 1942 ten days in which temperatures reached 95 degrees or more as compared to six for 1938. These warm days may have been partly responsible for subsequent low populations of 1941 and 1942. However, the population trend in early fields during 1941 was definitely upward throughout July and early August. In spite of the warm July days the stage appeared set for serious psyllid injury to the late crop, but it failed to develop (Table 2). A similar trend occurred in the 1942 early fields. One logical explanation for the lack of late season build-up would seem to be that August and September of both years were considerably cooler than the same months in 1938.

**Table 1. Comparison of certain weather data as recorded at Scottsbluff, Nebraska, during the period 1938 to 1946 with averages for the 26-year period (1921-1946).**

Season	Total Precipitation (inches)		July		Temperature September		August		Av. Mi
	July	August	Mean	Av. Ma.	Mean	Av. Ma.	Mean	Av. Ma.	
1938	2.54	0.69	74.4	90.2	75.1	92.5	65.4	81.2	49.6
1939	0.44	1.11	78.9	97.2	70.7	87.9	64.0	81.4	46.7
1940	1.38	0.47	76.3	94.4	69.7	86.9	64.8	80.8	48.9
1941	0.94	1.45	72.8	90.5	71.2	86.4	59.7	76.5	42.9
1942	1.40	0.40	73.2	91.7	70.3	88.1	58.5	76.5	40.5
1943	0.20	0.38	74.6	92.4	73.0	91.6	60.3	81.4	39.3
1944	1.99	1.37	71.0	85.8	71.9	88.2	62.1	79.2	45.0
1945	1.84	1.92	72.8	88.0	70.2	84.8	57.4	74.4	40.5
1946	0.07	1.08	75.8	92.3	70.6	85.7	61.6	77.0	46.1
Avg. 26-yr. period (1921-1946)	1.33	1.26	74.5	91.4	71.9	88.6	61.6	78.8	44.3

**Table 2. Average number PARATRIOZA COCKERELLI adults collected per 100 sweeps of insect net in early, medium, and late potato plantings at Scottsbluff, Nebraska, in 1941.**

Date of Collections	Date Fields Planted		
	April 26-28	June 2	June 20
May	30	1.3	
June	6	3.3	
	13	2.6	
	21	4.3	
	27	7.8	
July	3	9.6	1.3
	9	40.3	1.3
	16	31.8	2.0
	23	45.8	1.3
	31	42.3	2.3
August	8	69.4	4.6
	13		3.6
	19		5.0
	28		7.6
September	5	19.3	16.1
	12*		3.6

\* An early frost occurred on September 9.

Little is known concerning the source of the spring infestations and, for some reason, the initial population may have been extraordinarily heavy in 1938. Nevertheless, data presented here indicate a very definite relationship between the unusual weather sequence of a relatively cool, wet July,

followed by an exceptionally warm August and September, and the severe psyllid outbreak occurring in western Nebraska that season. Only once before during the period under discussion did such a weather sequence occur and that was in 1922, or the year Werner (8) first noted a serious number of abnormal plants with all the symptoms of psyllid yellows. Although the insect-disease relationship was unknown at that time, it is quite likely that psyllids were very abundant in Nebraska that year.

### Summary and Conclusion

A study of the weather data for Scottsbluff, Nebraska, during the 26-year period, 1921-1946, shows that the summer of 1938 was peculiar, in that an extraordinarily wet July with very few hot days was followed by two months of exceptionally warm weather. It was that season in which psyllid yellows disease was unusually severe and was responsible for an estimated loss of 25 per cent of the commercial potato crop.

From what is known of the seasonal life history of the potato psyllid such a weather sequence provides conditions approaching the optimum for the development of a heavy population of this insect. The absence or infrequent occurrence of hot July days permits the psyllid to migrate from early summer hosts to the late crop and there become established on the small plants at a time when the foliage offers little protection from the heat. Later, however, relatively high temperatures become essential for the maintenance of optimum developmental conditions, when vine growth is dense enough to shade the lower portions of the plants and the soil surface.

In order for serious psyllid injury to occur in late potato fields of western Nebraska, there appears to be needed a source of early infestation and a favorable weather sequence of a cool, moist late June and July followed by an unusually warm August and September. Sources of initial infestations are not fully understood, but the increasingly popular local practice of removing potential spring and early summer breeding places through the elimination of early potato plantings and volunteer growth on cull dumps should serve to curtail psyllid populations considerably. Such practices greatly lessen chances of another serious psyllid epidemic in this area.

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## A NEW GENUS OF CORIXIDAE

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Some years ago in examining the Matsumura types of Corixidae, I was impressed by the uniqueness of his *C. miyakei* and recently, in revaluing the genera of the world, Doctor Reece I. Sailer, Miss Addie Egbert and I have decided that a new genus should be proposed for this species so that it may be included in the key which is presented in a forthcoming paper.

### *Xenocorixa* new genus

Having the general facies of some *Hesperocorixa*. Lateral lobe of prothorax elongate, its anterior distal angle produced. Mesoepimeron very broad with a secondary suture extending across it from the lateral bend to the inner basal angle of the mesoepimeron. Metaxphus well developed. Legs short and stout. The hypo-ocular suture of the head arises near the rounded inferior angle of the eye and curves laterad to a point on the genal margin less than half way along the ventral margin of the eye. The last antennal segment very short, not over thirty percent of third segment. Pronotum and hemelytra shining, the former rastrate. The pruinose area along the base of the claval suture short and broad; vein M distinct but almost parallel with and very near to vein Cu. Males with dextral strigil.

Genotype: *Xenocorixa vittipennis* (Horvath) (= *C. miyakei* Mats. and S. horni Jaczewski).

## NOTES ON KANSAS BUTTERFLIES WITH DESCRIPTION OF A NEW SUBSPECIES.

DON B. STALLINGS AND J. R. TURNER

Caldwell, Kansas.

For the past several years we have been collecting in the "Red Hills" of Barber County, Kansas, and south into Oklahoma around Freedom.

There are several species of butterflies of this area that show subspecific characters, one of which is described in this paper. In addition one new species has been discovered which is being described in a separate paper by our good friend, H. A. Freeman.

During the collecting season of 1946 we were able to collect a good series of *Amblyscirtes oslari* Skin. in this area, definitely establishing that this species is a native of Kansas. It frequents the narrow canyons of the area.

A long series of *Glaucopsyche lygdamus* (Doubleday) was collected which merit subspecific status.

*Glaucopsyche lygdamus jacki* new subspecies.

Briefly this subspecies might be described as having the maculation of eastern *lygdamus* and the size of western *lygdamus*.

**Male: Upper Surface:** Wings with narrow black border fringed with

white. Costal area of forewing dusted with white. Outer fourth of veins edged with black, balance of veins lightly dusted with white. Remainder of wings bright blue with iridescence from green to purple depending on angle of refraction. The bright blue color resembles the color of *lygdamus* from Michigan and Ontario, except that it is much brighter.

**Under Surface:** Ground color grey-brown, showing more brown than *oro* Scudder from Colorado but less brown than in Michigan or Ontario specimens. Forewing has a submarginal row of black spots (normally 6 or 7) and a black bar in the discal area all faintly edged with white. Hindwing with a submarginal row of black spots (normally 8 or 9) black discal bar and a black spot above the discal bar. Less than 10 per cent of the specimens show a black spot between the body and discal spot. All spots faintly edged with white.

**Female: Upper Surface:** Fringe of wings white with black discal bar in forewing. Ground color of wings dark slate to black, inner half of forewings sparsely dusted with bright blue with even less blue on hindwings.

**Under Surface:** Similar to males.

There are four distinguishing characters in this subspecies:

1. The bright blue coloring has a more metallic luster than any other *lygdamus*.
2. The grey-brown ground color of undersurfaces intergrades between eastern and western specimens.
3. The blue on the females is generally more sparse than on other *lygdamus*.
4. The veins of the males appear raised due to the peculiar edging.

**Holotype:** Male. Expanse 26 mm. Barber County, Kansas, 4-7-46.

**Allotype:** Female. Expanse 29½ mm. Barber County, Kansas, 4-7-46.

**Paratypes:** 73 males and 15 females, Barber County, Kansas, 4-7-46.

31 males and 16 females, Barber County, Kansas, 4-14-46.

2 females, Barber County, Kansas, 4-28-46.

2 males, Freedom, Okla., 4-21-46.

2 males and 2 females, Salt Plains, Okla., 4-12-46.

1 male, Salt Plains, Okla., 4-13-46.

Type series collected by Dr. and Mrs. R. C. Turner, Jr., Dr. J. R. Turner, Mr. and Mrs. Harry E. Jenista and sons, Leon, Harry Edward and Marion, Mr. and Mrs. Don B. Stallings, and sons, Dee and Jack.

Names in honor of John (Jack) R. Stallings, son and nephew of the authors.

The range of this subspecies can be expected to be west of a line drawn north and south through Wichita, Kansas, and Enid, Okla., ranging west on the plains till it is replaced by *oro* the mountain subspecies in Colorado. Northward it should range into Nebraska and should occur throughout western Oklahoma and northern Texas, meeting *oro* in New Mexico.

Holotype and allotype will remain in the author's collection for the present. Paratypes will be distributed to various museums and private collections.

NEW NORTH AMERICAN MUSCOID DIPTERA<sup>1</sup>

H. J. REINHARD

College Station, Texas.

The following descriptions of new sarcophagine genera and species are based upon material in the Snow Entomological Collections at the Kansas University and in my collection. I am greatly indebted to Dr. R. H. Beamer for the privilege of studying the extensive accumulations of Sarcophaginae added to the Snow Collection during recent years. All types of new species represented in the latter material are returned to the Kansas University Museum as mentioned under the descriptions.

*Xenoppia monela*, n. sp.

## Fig. 1

**Male.**—Front at vertex 0.30 of head width, slightly narrowed downward thence widening gradually in facial angle; frontal vitta deep brownish black, much wider than parafrontal; ocellars proclinate, hairlike; outer verticles well developed; orbital bristles absent; frontals in a single row diverging beneath antennal base and extending almost to apex of second segment; parafrontals and parafacials gray pollinose, with a row of delicate hairs extending from vertex along eye margin to cheek grooves, lowermost two or three hairs somewhat coarser but not bristly; cheeks gray pollinose, one-fifth eye height; vibrissae on oral margin, latter moderately bowed forward; facial ridges bare; antennae black, nearly as long as face, third segment subequal to one-fourth longer than second; arista black, basal third moderately thickened and bearing rather short hairs which scarcely exceed the maximum diameter of the arista; proboscis short, labella fleshy; palpi black, bowed and moderately thickened apically; eyes bare; occiput plumbeous, with three rows of black hairs above and with finer pale hairs at middle below.

Thorax and scutellum black, gray pollinose, with three not very sharply defined dark vittae above. Chaetotaxy: acrostichal 0,1 (prescutellar small); dorsocentral 2,3; intraalar 1; supraalar 3; presutural 1 (outer); sternopleural 3; scutellum with 2 lateral (large), apical and discal pairs absent; prosteronum and propleura bare; postnotal slopes setose.

Legs black; middle femur without comb; middle tibia with two large anterodorsal bristles; hind tibia not villose, claws and pulvilli moderately long.

Wings gray hyaline; first vein bare, third setulose nearly to small cross vein; first posterior cell narrowly open well before wing tip; costal spine strong, much longer than small cross vein.

Abdomen black, with grayish pollen in a tessellated pattern, which extends thinly to hind margin on last three segments above; median vitta broad and rather constant, one on either side narrower and changeable with angle

<sup>1</sup>Contribution No. 1033, Division of Entomology, Texas Agricultural Experiment Station.



of view; first segment without median marginals, second and third each with one large pair; fourth with a complete marginal row.

Hypopygium large, black with plumbeous pollen above; first segment bearing one pair of discal bristles and a marginal row of six; second segment near base above with four good-sized upcurved bristles; fifth sternite black, deeply incised with inner margin of lobes widely divergent behind; forceps black, rather short, tapering and gently bowed in profile, united to tip and clothed with fine hairs on the slightly keeled hind side; hind clasper slender, curved and tapering to sharp tip; front clasper much heavier, directed forward from near base, tip broad, obliquely truncate; penis brownish with a slender unjointed stalk, bowed forward and upward at apex terminating in a vaselike tip, with the incurved upper apical extremity slightly produced; immediately in front of latter are two small processes, one very delicate or hairlike curved laterally, the other shorter and heavier directed basad.

Female.—Front at vertex 0.40 of head width, equibroad nearly to antennae; frontal vitta subequal to slightly wider than one parafrontal; two proclinate orbitals; abdomen broad ovate; genitalia black, first segment devoid of hairs on upper surface but hind margin fringed with bristly hairs; sixth and seventh sternites black or reddish black, with hind margin of last broadly and deeply emarginate; legs stoutish, claws and pulvilli shorter than last tarsal segment.

Length, 8.5-9.5 mm.

Holotype: Male, Cape Sable, Florida, February 1, 1941 (L. L. Pechuman). Allotype: Female, Harris County, Texas, May 29, 1921 (H. J. Reinhard). Paratypes: 1 male, "Cameron County, Texas, November 19, 1931"; 1 female, "Charleston, S.C., Jan. 3"; and 1 male, Raleigh, N.C., July 17, 1940 (C. S. Brimley).

The species differs from the genotype, *X. hypopygialis* Townsend (*Campopyga aristata* Aldrich) mainly in genital peculiarities; also, the parafacials are much less strongly bristled and the second abdominal segment in the male bears a pair of large erect median marginals.

#### *Xenoppia valgata*, n. sp.

##### Fig. 2

Male.—Very similar to the preceding species in most essential details but the second abdominal segment lacks large median marginals, the parafacials bear a single good-sized bristle on the lower extremity near eye margin, and the genitalia are strikingly different. Other minor differences may be mentioned as follows:

Front at vertex 0.33 of head width (one specimen); parafrontals and parafacials subsilvery, cheeks and occiput cinereous; thorax with three moderately broad and well defined brownish vittae; two large intraalars; prescutellars small but distinct; abdomen above with whitish pollen which is heavier on basal margin of last three segments and interrupted by three fairly constant blackish vittae. Hypopygium large, subshiny black, lightly dusted with gray pollen above; forceps black, rather thick at base and

tapering in profile, flattened and subtriangular in rear view with narrow tips separated but not divergent; claspers short and curved, anterior ones broad to oblique tips; penis reddish brown, stalk long and slender, not jointed but sheathed on basal three-fifths or more; apex of penis expanded and subdivided with the forwardly directed part terminating in a narrow pale membrane, on the hind side distally are two slender blunt-tipped processes, shortly above these is a second and more delicate or hairlike pair that curve outward thence upward; fifth sternite blackish, with a narrow median incision, lobes thickly beset with short black hairs on hind margin.

Length, 7.5 mm.

Holotype: Male, Houston, Texas, May 27, 1921 (H. J. Reinhard).

*Cattasoma*, n. gen.

Male fifth sternite entire as in *Sarcofahrtia* and *Erythrandra* but differing from both in having a much smaller build; vibrissae short with tips scarcely meeting; male front in profile less prominent, wide and equibroad from vertex to antennae.

Frontal bristles rather weak, in single parallel rows stopping at or a trifle beneath antennal base; orbitals and outer verticals absent; ocellars widely divergent and slightly proclinate; antennae subequal length of face, third segment barely twice length of second; arista moderately thickened on basal third, short-haired to middle thence micro pubescent nearly to tip, second segment short; parafacials setose except on inner margin, not much wider than third antennal segment; facial ridges bare; vibrissae near oral margin and not very high above lower margin of head; haustellum very short, labella fleshy; palpi stout, spatulate; eye bare, nearly vertical, not quite reaching vibrissal level; cheeks three-fifths eye height; occiput convex with three rows of short bristly hairs above. Propleura and prosternum bare; postnotal slopes setose; anterior acrostichals absent, prescutellar pair well developed; postsutural dorsocentrals three; sternopleurals two; scutellum with two good-sized marginal and one smaller discal pair. Male claws and pulvilli moderately elongate, middle femur with comb. Wings reaching well beyond tip of abdomen; first vein bare, third setulose over halfway to small cross vein; first posterior cell narrowly open at costa about length of small cross vein before wing tip; costal spine small but distinct. Abdomen at base as wide as thorax but rather strongly narrowed towards tip; basal segments without median marginals, third with one slightly differentiated pair, fourth with marginal row of eight or ten somewhat stouter bristles; hypopygium prominent.

Genotype: *Cattasoma mediocris*, n. sp.

*Cattasoma mediocris*, n. sp.

Fig. 3

Male.—Front nearly half as wide as long, at vertex 0.33 of head width, diverging into facial angle on lower extremity; frontal vitta reddish brown, thinly pollinose, equibroad on entire length and much wider than para-frontal; antennae and palpi red, thickened tips of latter slightly infuscated;

parafrontals and parafacials pale yellowish gray, clothed with minute black hairs not arranged in distinct rows; cheek grooves red, this color extending across oral margin and upward to include lower part of face and its lateral ridges; cheeks beset with short fine black hairs; occiput cinereous, wholly black-haired.

Thorax black, densely gray pollinose, with three to five narrow and not very well defined dorsal vittae; pleural hairs fine and short, wholly black; scutellum black, with spare hairs on middle above; intermediate marginal bristle small.

Legs black, femora moderately stout, thinly pollinose; mid tibiae with one anterodorsal bristle; hind coxae not haired on hind side; claws and pulvilli equal or slightly exceeding length of last tarsal segment.

Wings hyaline; epaulets bright reddish yellow; hind cross vein oblique, joining fourth much nearer bend than small cross vein, latter slightly before apex of first vein; calypters white, rounded, hind lobes normal in size.

Abdomen wholly gray pollinose, with three black dorsal vittae, outer ones more or less interrupted and showing as spots in some views; sternites moderately exposed, fifth one entire and evenly rounded on hind margin.

Hypopygium rather large; first segment black, gray pollinose above, bearing a transverse row of four stoutish discs and four weaker marginal bristles; second segment obscurely reddish, thinly pollinose and clothed with fine black hairs; forceps short, reddish brown, narrow tips divided but not divergent; anterior claspers moderately strong, directed forward from near base, hind pair much shorter and visible only in direct ventral view; accessory process small, fingerlike, far before base of forceps; penis with a rather short slender basal stalk, terminating in a bowed and slightly enlarged hollow apex which has the apical extremity deeply emarginate, on the front side near middle and close to the stalk are a pair of small hook-like processes directed upward, with a second more loosely attached larger pair extending forward and upward from about the same level.

Length, 5.5 mm.

Holotype: Male, Big Bend Park, Brewster County, Texas, July 1, 1937 (R. H. Baker).

#### *Cattasoma festinans*, n. sp.

##### Fig. 4

Male.—Very similar to the preceding species in all essential items but at once distinguished by wide morphological differences in the genitalia.

Hypopygium reddish black basally, second segment wholly reddish, forceps red, short but slender, rather widely separated on apical three-fifths; accessory process small, well before base of forceps; anterior claspers unusually long, narrow at middle thence widened to a broadly rounded apex with the anterior apical extremity minutely dentate; penis gently curved and slender in profile, bearing a chitinized semitransparent process above middle on front side which extends forward between the anterior claspers; fifth sternite entire, wholly red.

Length, 4 mm.

Holotype: Male, Marathon, Texas, July 9, 1938 (Jean Russell), in the Snow Entomological Collections, Kansas University.

**Cacotrophus, n. gen.**

Head shape similar to *Cistudinomyia*, but the epistoma short and hardly narrowed from clypeus; latter much wider than parafacial; ocellars hair-like or entirely absent; male with well developed orbital bristles.

Vertex nearly one-third head width in both sexes, front equibroad to antennae; parafacial with single row of small hairs; facial ridges practically bare; vibrissae on oral but well above lower edge of head; frontals weak, in single rows slightly diverging anteriorly, one or two bristles below antennal base; verticals two pairs; orbitals two proclinate and one reclinate in female, one proclinate and one reclinate in male; antennae subequal length of face, second segment over half as long as third; arista moderately long plumose on basal half or more; proboscis short, labella large; palpi longer than haustellum; eyes bare; cheeks fully two-fifths eye height. Thoracic chaetotaxy: acrostichal 0,1 (prescutellar pair well developed); dorsocentral 3,4 (two immediately behind suture small); presutural 1 (outer); humeral 2; notopleural 2; sternopleural 2; scutellum with 3 lateral and 1 smaller discal pair, no apicals; prosternum, propleura and postnotal slopes sparsely setose. Legs long but not very slender; male mid femur without comb; hind tibiae not villose. Wings rather short; venation normal; costal spine vestigial. Abdomen ovate, flattened above, with tip broadly truncate in female; segments one and two without median marginals, third with one pair and fourth with a complete marginal row.

Genotype: *Cacotrophus beameri*, n. sp.

***Cacotrophus beameri*, n. sp.**

**Fig. 5**

Male.—Head whitish pollinose on pale ground color, occiput darker and cinereous; parafrontals with only a few short inconspicuous hairs along outer margin; frontal vitta red, narrower than one parafrontal; antennae reddish brown; arista slender, a little thickened near base, tips moderately swollen; cheeks clothed with fine black hairs; eye slightly oblique, not quite reaching vibrissal level; occiput largely black-haired, a few paler ones at middle below.

Thorax black, gray pollinose, with three velvety black dorsal vittae, outer pair stopping shortly before scutellum, median one extending over disc of latter; pleura black-haired.

Legs black, tibiae with a slight reddish tinge in ground color; mid tibia with two smallest anterodorsal bristles; claws and pulvilli shorter than apical tarsal segment.

Wings hyaline; first vein bare, third setose less than halfway to small cross vein; first posterior cell open well before wing tip; epaulets blackish; calypters white, hind lobes rather small, longer than wide.

Abdomen black becoming reddish on sides, with moderately thick gray pollen on upper surface in a tessellate pattern leaving three black vittae which are changeable with the angle of view; fifth sternite reddish yellow, with a median V-shaped incision, lobes rather thickly clothed with fine black hairs on inner margin.

Hypopygium moderately large, red; first segment above thinly white pollinose, with a marginal row of eight or ten bristly hairs, no discs; second segment slightly pruinose to subshiny, with a vestiture of fine black hairs on entire surface above; forceps long, bowed and tapering in profile, divided beyond middle but tips not divergent; accessory process only a little shorter than forceps, narrow at base and gradually widened toward tip; anterior forceps reddish, broad on basal part suddenly narrowed and bowed forward on apical half; hind claspers yellow, strongly compressed, not quite so broad basally and gradually tapering outward to narrow curved tips; penis yellow, apparently single-jointed, curved forward and but slightly thickened to a rounded apical rim, the apex bearing a pair of small forwardly directed processes which are strongly bowed leaving a small opening beneath them visible in profile; from near base of penis behind a rodlike process extends briefly rearward thence down and forward between the posterior claspers reaching the penis stalk shortly above the point of curvature; the latter process is almost entirely obscured by the forceps and claspers in lateral view.

Female.—Very similar to male except for sexual differences. Genital segments red, retracted; orifice vertical and slitlike, margin of latter fringed with a row of black bristly hairs.

Length, 7 mm.

Holotype male and allotype female, Huachuca Mts., Arizona, July 8, 1932 (R. H. Beamer), in the Snow Entomological Collections, University of Kansas.

The species is named for Dr. R. H. Beamer, through whose extensive collecting of insects many new and unusual forms have been brought to light.

### *Sarcophaga pagella*, n. sp.

#### Fig. 6

Traces to *S. hospes* in Aldrich's key, but the head pollen mostly grayish, first abdominal segment without median marginals, and the genitalia differing in morphological details.

Male.—Vertex 0.23 of head width, front equibroad to lower third thence widening in facial angle; frontal vitta velvety red to deep brown or black, wider than parafrontal; inner verticals straight, outer ones and orbitals absent; ocellars moderately large; frontals in single rows which diverge anteriorly, two or three bristles beneath antennal base; parafacials moderately wide, with black hairs on outer margin which became coarser near lower extremity; facial ridges finely haired to middle; antennae largely black, third segment hardly twice length of second, reaching to lower

fourth of face; arista long plumose on basal half or more; vibrissae on oral margin; palpi black, longer than haustellum; cheek one-third eye height; occiput with three rows of black hairs above, with some pale hairs above neck as well as below.

Thorax with rather dense gray pollen and three very distinct broad black vittae above; acrostichal 2,1 (all well developed, none near suture); dorsocentral 3,3; presutural 2 (inner one small); humeral 3; sternopleural 3; scutellum with two long lateral, 1 smaller decussate apical and 1 reclinate more widely spaced subapical pair; prosternum and propleura bare; postnotal slopes setose.

Legs black; mid tibiae with two anterodorsal bristles; mid femur with comb; hind tibiae not villous; claws and pulvilli subequal apical tarsal segment.

Wings subhyaline; first vein setulose on basal half and third halfway to small cross vein; bend of fourth vein rectangular with a distinct fold; first posterior cell open well before wing tip; costal spine shorter than small cross vein; epaulets black; calypters white, hind lobes with a light brownish shade at middle.

Abdomen black, with gray pollen, which is interrupted on intermediate segments by three changeable black vittae; second segment with one pair of median marginals, none on first; last two segments each with a complete marginal row.

Hypopygium wholly red, small and in repose largely retracted; first segment lightly pale pollinose and bearing four to six smallish bristles on hind margin above; second segment at most pruinose, with more abundant black hairs, mostly fine and short; forceps with the joined basal part strongly convex and bearing fine recumbent hairs; beyond this they are bent backward thence evenly arcuate on hind edge to a pointed apex; on the divided free part of the forceps near middle a thin lateral micro-spined ridge extends obliquely downward from anterior to posterior edge; accessory process red, small, narrowed apically; penis jointed near base, stalk short, tapering and somewhat constricted at base of apical segment; latter short, slender, bearing a small bilobed process near base above and tapering to a simple rounded apex; claspers short, hind pair curved, pointed, the front ones straighter and blunt-tipped; fifth sternite yellow, retracted, apical incision V-shaped, lobes sparsely black-haired.

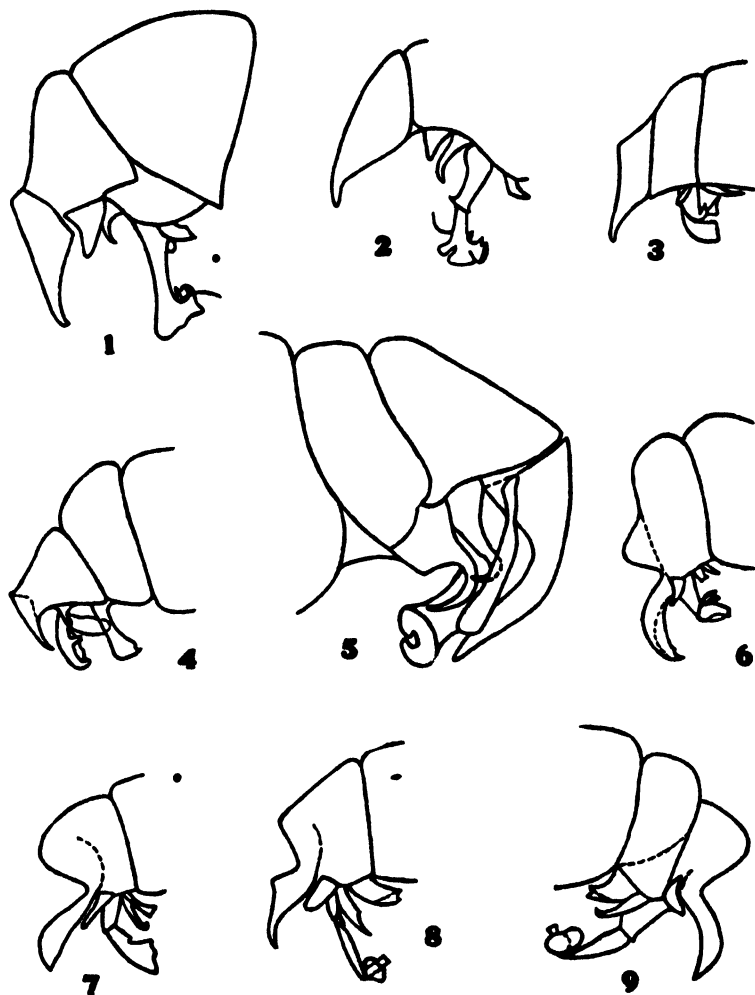
Length, 8-10 mm.

Holotype: Male, Bexar County, Texas, September 26, 1936 (H. J. Reinhard). Paratypes: 1 male, Menard, October 12, 1931 (H. E. Parish) and 1 male, Baboquivari Mts., Arizona, July 19, 1932 (R. H. Beamer) in the Snow Entomological Collections, Kansas University.

*Sarcophaga devulsa*, n. sp.

**Fig. 7**

Close to *S. spatulata* Aldrich (*Stenaulacotheca* Townsend), but considerably more robust in build; palpi and antennae black and there are slight differences in the genitalia.



Lateral View of Male Genitalia

## Plate I

- Figure 1. *Xenoppia monela*, n. sp.  
 Figure 2. *Xenoppia valgata*, n. sp.  
 Figure 3. *Cattasoma medlocris*, n. g. and n. sp.  
 Figure 4. *Cattasoma festinans*, n. sp.  
 Figure 5. *Cacotrophus beameri*, n. g. and n. sp.  
 Figure 6. *Sarcophaga pagella*, n. sp.  
 Figure 7. *Sarcophaga devulsa*, n. sp.  
 Figure 8. *Sarcophaga convana*, n. sp.  
 Figure 9. *Sarcophaga putilla*, n. sp.

**Male.**—Front at vertex 0.17 of head width, front slightly narrowed near middle thence widening rapidly downward; head black, gray pollinose; para-facials abundantly haired on outer half, moderately wide; vibrissae near oral margin; facial ridges weakly bristled to middle; third antennal segment one and one-third times length of second; arista plumose to middle; two or three frontals below antennal base and moderately divergent from row; outer verticals vestigial; ocellars proclinate; proboscis short; cheeks slightly exceeding one-fourth eye height; occiput wholly black-haired.

Thorax gray with three wide black vittae above; dorsocentral 3,3; acrostichal 2,2; sternopleural 3; scutellum with 2 lateral, 1 decussate apical and 1 subapical pair; prosternum and propleura bare.

Legs black; hind tibiae not villose, preceding pair with one anterodorsal bristle; mid femur with comb; claws and pulvilli elongate.

Wings subhyaline, slightly infuscated basally; costal spine small but distinct; first vein bare, third haired halfway to small cross vein; calypters brownish.

Abdomen with changeable gray pollen and three black vittae above; basal segments without median marginals, last two each with a marginal row; fifth sternite blackish, divided, mostly concealed.

Hypopygium small, black, second segment slightly reddish above; forceps strongly convex near base behind, thence bowed backward; the free part pale yellow, thin or bladelike and beset with micro spines on sides, divided but not divergent in rear view; accessory process small, tapering to a delicate tip; penis rather slender, jointed, with yellow basal segment about as long as apical, latter bearing a pair of blackish lobes on front side which in lateral view appear as part of the main segment widening same to apex; claspers small and slender, hind pair hooked at tips, the anterior ones with broadened tips emarginate.

Length, 7.5–8 mm.

Holotype: Male, Amherst, Ohio, July 14, 1934 (H. J. Reinhard). Paratype: 1 male, same data as type.

*Sarcophaga hunteri aenigma*, n. subsp.

**Male.**—With the essential characters of *S. hunteri* Hough (*Protodexia* Townsend), including structural features of genitalia except the claspers and accessory process are considerably smaller and the posterior basal lobes of the forceps lack the characteristic tuft of long straight hairs on the apex.

Length, 5.5–6 mm.

Holotype: Male, Babylon, L. I., N. Y., August 28, 1935 (Blanton & Borders). Paratype: 1 male, Lakeville, N. Y., July 30, 1921 (H. C. Huckett).

*Sarcophaga convena*, n. sp.

**Fig. 8**

Allied to *S. flavipes* Aldrich (*Acridiophaga* Townsend), but the first vein bare, legs black and the fourth abdominal segment wholly red. Other differences are listed below.

**Male.**—Front at vertex 0.17 of head width, equibroad to middle thence widening rapidly downward; parafrontals and parafacials gray pollinose,



latter rather narrow, with two rows of black hairs becoming coarser or bristly below; frontal vitta black, wider than parafrontal; outer verticals and orbitals absent; ocellars slender, not large; frontals in single rows diverging anteriorly, two to three bristles below antennal base; vibrissae strong, slightly above oral margin; facial ridges black, setose almost to middle; antennae black, third segment twice length of second and reaching to lower fourth of face; arista with usual plumosity on basal half or more; proboscis short, labella large; palpi black, longer than haustellum; cheeks black gray pollinose, with black hairs, nearly one-third eye height; occiput with three rows of black bristles above and rather sparsely pale-haired below.

Thorax gray pollinose, with the usual three to five black vittae above; acrostichals 3,2; dorsocentrals 3,3; presuturals 2 (inner one smallish); scutellum with 3 lateral (intermediate one small), 1 good-sized decussate apical and 1 widely spaced subdiscal pair; prosternum, propleura and postnotal slopes haired.

Legs moderately long; hind tibiae not villose, middle pair with one anterodorsal bristle; mid femur with about four stubby spines on lower anterior edge; claws and pulvilli elongate.

Wings subhyaline; costal spine vestigial; first vein bare, third setulose nearly halfway to small cross vein; first posterior cell open well before wing tip; calypters large, white with a tawny tinge.

Abdomen black with fourth segment wholly red, gray pollinose above except on three changeable black vittae; last two segments each with a marginal row of stoutish bristles; one weak depressed median marginal pair on second segment, none on first; fifth sternite red, with an apical V-shaped cleft, lobes sparsely black-haired.

Hypopygium small, wholly red; first segment white pollinose, bearing four slender bristles on hind margin; second segment subshiny with sparse short black hairs above; forceps pale yellow, strongly humped on united basal portion, thence bent back and the free part obtusely humped near middle on hind side, latter beset with micro spines except on narrow forwardly bowed tip; penis reddish, slender, with basal segment slightly shorter than apical; latter very thin in profile, bearing a pale, semitransparent lobe on either side near tip, between these there is a small blackish process directed forward at nearly a right angle to the main segment; accessory process yellow, rather broad and parallel to rounded tip; anterior clasper yellow, stout, curved, with a thin oblique ridge near tip; hind clasper rather slender, tapering to an acute curved tip.

Length, 9 mm.

Holotype: Male, College Station, Texas, May 23, 1943 (H. J. Reinhard).

*Sarcophaga putilla*, n. sp.

**Fig. 9**

Male.—Very similar to the preceding species, except as follows: Front at vertex 0.20 of head width, slightly narrowed before ocellar triangle; para-facial nearly one-half clypeal width, with sparse hairs in a single row;

cheek one-third eye height; second abdominal segment without median marginals, fourth with a blackish tinge on narrow basal margin above; genital forceps with the free part evenly arcuate behind; penis stouter, with the apical lobes thick or padlike and covering all but extreme tip of the forwardly directed copulatory tube; anterior claspers stout and curved but not sharply ridged on outer side, tips rather broad and emarginate; accessory process small, bowed, tapering to a narrow tip; fifth sternite yellow, largely concealed.

**Female.**—Front at vertex 0.27 of head width, gradually widened forward to antennal base; outer verticals not developed; two stout proclinate orbitals; cheeks with coarse black hair, slightly over one-third eye height; apical scutellars lacking; fourth segment orange red, genitalia concolorous with subvertical oval orifice; sixth and seventh tergites rather narrow, transversely convex behind, directed up and rearward and the last tapering to a narrow rounded tip beset with small black hairs.

Length, 5.5-9 mm.

**Holotype:** Male, Amherst, Ohio, July, 1933 (H. J. Reinhard). **Allotype:** Female, same data except dated July, 1934. **Paratypes:** 2 males and 3 females, same data as type and 1 male, Wisconsin, July 1, 1930, without precise locality or collector's label.

#### ***Sarcophaga ignipes*, n. sp.**

Differs from the two preceding species in having bright red legs and palpi, and from *S. flavipes*, in having the prosternum and propleura haired, first vein of wing bare, and fourth abdominal segment wholly red.

**Male.**—Front slightly narrowed near middle, at vertex 0.18 of head width; parafrontals and parafacials subsilvery, the latter with two or more rows of black hairs becoming bristly below; outer verticals and orbitals absent; ocellars slender, long; frontals about twelve, rather strong, diverging anteriorly, three beneath antennal base; facial ridges bearing a few hairs next to vibrissae; latter large, near oral margin; antennae mostly black, third segment slender, barely twice longer than second; arista long plumose on basal three-fifths or more; palpi slender, longer than haustellum; cheek with gray pollen and coarse black hairs, over one-third eye height.

Thorax gray with three to five black dorsal vittae, strongly bristled; post-sutural dorsocentrals 3, anterior acrostichals 3; prescutellars medium-sized; sternopleural 3 (large); scutellum with 2 lateral (hindmost reaching beyond base of third abdominal segment), 1 good-sized decussate apical and 1 subdiscal pair; postnotal slopes setose.

Legs long but not very slender, red with tarsi blackish; hind tibiae not villous, middle pair with one stout anterodorsal bristle; mid femur without distinct comb, the bristles spiny but rather widely spaced; claws and pulvilli long.

Wings gray hyaline; costal spine small; third vein setose three-fourths distance to small cross vein; hind and apical cross veins very oblique and in same plane, latter reaching costa well before wing tip; calypters large, hind lobes infuscated with narrow rim paler.

Abdomen gray tessellated above, with three dark vittae; basal segments without median marginals, third with a stout pair and four laterals at some distance from them; fourth segment with a complete marginal row; fifth sternite yellow, with an apical V-shaped cleft.

Hypopygium small, wholly red; genitalia as in *S. putilla*, but the penis considerably shorter, with apical lobes large but distinctly thinner in profile; posterior clasper very slender, tapering to a minute curved tip; anterior clasper short, not very stout, strongly bowed and blackish on apical half, tip blunt; accessory process slightly wider on entire length.

Female.—Front at vertex 0.24 of head width, diverging gradually to antennal base; two proclinate orbitals; outer verticals usually not differentiated; palpi at times infuscated apically; second antennal segment red; apical scutellars absent; second abdominal segment without strong median marginals, third and fourth bearing a complete marginal row; genitalia as in *S. putilla*; claws and pulvilli shorter than in male.

Length, 6.5-9 mm.

Holotype: Male, College Station, Texas, June 2, 1946 (H. J. Reinhard). Allotype: Female, same data except dated May 13, 1945. Paratypes: 4 females, College Station, Texas, May-June, 1944-46 (H. J. Reinhard).

#### *Sarcophaga alopecis*, n. sp.

##### Fig. 10

Male.—Like *S. falciformis*, except as follows: Front at vertex 0.21 of head width, narrowed before ocelli thence widening rapidly in facial angle; antennae wholly black, three-fourths length of face, third segment one-half longer than second; mesonotal hairs rather long and fine; sternopleura bearing three strong bristles and numerous long hairs some bristlelike above; second abdominal segment with one pair of well developed median marginals, third and fourth with a marginal row; genital forceps wholly red, in profile the basal part is strongly bulged with a deep emargination immediately below this, the free part beyond is rather broad, convex on the outer side which is thickly beset with minute stubby spines; anterior forceps short with slender tips slightly curved; posterior forceps somewhat heavier and more strongly bowed apically; penis with a short yellow basal segment, the apical one a little longer, rather slender, bearing a small black globular process and a pale crescentiform membrane on front side near tip; the extreme apex behind terminating in two small diverging pronglike processes which are bowed forward; fifth sternite red, lobes largely concealed, with sparse black hairs on hind margin.

Female.—Six specimens labeled as the males and presumably taken in company with same are provisionally considered as belonging here. Except for the usual sexual differences and grayer general aspect the characters are similar to the male. Genitalia red, with subchitinated apical sternites tapering distally to a blunt and moderately protruding tip.

Length, 6.5-10 mm.

Holotype: Male, Sioux City, Iowa, June 18, 1921. Paratypes: 3 males and 6 females same data as type.

*Sarcophaga mendax*, n. sp.

## Fig. 11

Belongs to Aldrich's group A, having three post dorsocentral bristles, hypopygium wholly black and male hind tibiae villose. There appears to be no closely related species that has been previously described.

Male.—Front at vertex 0.20 of head width, slightly narrower below ocelli thence widening rapidly downward; parafrontals and parafacials pale yellowish gray pollinose, the latter with a row of hairs on outer margin becoming bristly on lower extremity; frontal bristles in single rows diverging anteriorly, two below antennal base; ocellars small; outer verticals absent; antennae black, reaching lower fifth of face, third segment not quite twice length of second; arista long plumose on basal three-fifths or more; vibrissae near oral margin; proboscis short, stout; palpi black, longer than haustellum; cheeks grayish, with black hairs, hardly one-third eye height; back of head with three rows of black bristles above and finer pale hairs around the middle and below.

Thorax gray pollinose with three to five black vittae above; prescutellar bristles medium large; anterior acrostichals vestigial; sternopleurals three; scutellum with two strong lateral, one small decussate apical and one pre-apical pair; prosternum and postnotal slopes haired; propleura bare.

Legs black; mid tibiae with one anterodorsal bristle; claws and pulvilli elongate; mid femur without comb.

Wings subhyaline; first vein bare, third setulose over halfway to small cross vein; first posterior cell open well before wing tip; costal spine vestigial; calypters white.

Abdomen black, with gray pollen above in a tessellated pattern; basal segments without, third with one pair of median marginal bristles, fourth bearing a marginal row; fifth sternite reddish black, with a wide and deep V-shaped apical incision, inner edge of lobes fringed with black inwardly directed hairs.

Hypopygium black, lightly dusted with gray pollen but moderately shiny in some views; first segment without differentiated bristles on hind margin; second segment globose, clothed with fine longish hairs above; forceps black, curved gently forward, the posterior apical extremity ending in a minute tooth; accessory process red, moderately large, beset with numerous short black hairs near tip; penis not very large, its basal segment translucent white, soft in structure except hind margin which is darker and chitinated; distal segment blackish, subovate in profile, with a median apical claw bowed closely forward between two anterior processes; each of the latter originate at the base of the segment, extend forward to tip of median claw thence rearward tapering to an acute curved tip; posterior claspers rather short and wide at base, tips flattened; anterior claspers longer, strongly bowed, flattened apically and notched on outer side near apex.

Length, 8.5 mm.

**Holotype:** Male, Great Smoky Mts. Ntl. Pk., Tenn., July 15, 1926 without collector's label.

***Sarcophaga elanis*, n. sp.**

**Fig. 12**

**Male.**—Very similar to *S. mendax*, differing mainly in the morphological details of the genitalia. Other minor differences may be listed as follows: Head pollen gray, parafrontals becoming blackish near vertex, which measures 0.21 of head width; cheeks over one-third eye height; thorax rather thinly gray pollinose above and subshiny, pleura more so; prosternum bare; mid tibiae with two anterodorsal bristles; third abdominal segment with marginal row of good-sized bristles; fifth sternite retracted, inner margin of lobes reddish, sparsely black-haired.

Hypopygium wholly black, sprinkled with gray pollen but the surface subshiny in most views; neither segment bristled, sparse fine hairs on first and more abundant coarser ones on second; forceps reddish black on the broad united base, divided and moderately diverging distally, each prong terminating in a small curved tooth; accessory plate red, ordinary in size, moderately hairy; penis with a brown, rather short basal stalk, distal segment moderately swollen, directed forward and divided into two subsegments, the apical one largest, bearing a slender process at the apex which curves over the tip of the copulatory tube and terminates in a delicate pale membrane; both claspers rather stout, directed forward from base, tips flattened and blunt.

Length, 8 mm.

**Holotype:** Male, "Essex Co., N. Y., June 14, 1924," without collector's label.

***Sarcophaga hesterna*, n. sp.**

**Fig. 13**

**Male.**—Exceedingly like *S. acadiana*, but with different hypopygial characters. Other distinguishing items in the present species may be mentioned: Front wider, measuring 0.21 of head width at vertex; hind tibiae rather thickly villose; mid femur without comb; preapical scutellars well developed; fourth abdominal segment wholly black, etc.

Hypopygium not very large; first segment black gray pollinose, with a row of bristles on hind edge; second segment red, subshiny, sparsely haired above; forceps reddish on basal half thence shining brown, divided and moderately divergent distally, as viewed from behind each prong rather thin, bearing a patch of short spinose hairs before apex, latter minutely toothed; accessory process red, with longish hairs on front apical margin; penis rather slender, jointed near middle, basal stalk whitish in front and brown on hind edge; distal segment hardly at all thickened, subovate in profile with the anterior apical extremity deeply emarginate, the median beak small, curved forward and tapering to a thin membrane which overlaps the copulatory tube; shortly in front of latter and arising from within the segment a pair of small and slender processes protrude slightly towards

the front thence curve upward; both claspers rather small, the anterior one decidedly flattened, with broadly rounded tip.

Length, 9.5 mm.

Holotype: Male, "Westport, N.Y., July 12, 1922," no collector's label.

*Sarcophaga acadiana*, n. sp.

Fig. 14

Allied to *S. sima*, but readily distinguished by obvious differences in structure of the genitalia.

Male.—Vertex 0.18 of head width, front somewhat narrower before ocellar triangle; parafrontals and parafacial gray, the latter with a single row of hairs on outer margin; frontal bristles rather short, in single rows diverging anteriorly with three below antennal base; inner verticals short and stoutish, outer ones absent; ocellars small; antennae black, third segment over twice length of second and reaching lower fourth of face; arista long plumose on basal half or more; vibrissae on oral margin; proboscis short; palpi black, normal in size; cheek gray pollinose, with black hairs, one-third eye height; occiput with three rows of black hairs above and rather abundant pale hairs above the neck becoming sparser below.

Thorax gray pollinose, with three to five black vittae above; anterior acrostichals vestigial; posterior dorsocentrals three; prescutellars missing but the scars large indicating a well developed pair; sternopleurals three; scutellum with two lateral and one decussate apical pair, no preapicals, prosternum and propleura bare; postnotal slopes haired.

Legs black; hind tibiae with rather sparse long hairs on inner edge except near base, middle pair bearing one anterodorsal bristle; middle femur with comb; claws and pulvilli longer than apical tarsal segment.

Wings hyaline; costal spine small; first vein bare, third setulose over halfway to small cross vein; calypters white.

Abdomen with gray tessellated pollen above, black, fourth segment red on hind margin, this color extending forward on median line to basal third of same; segments one and two without median marginals, last two each with a complete marginal row.

Hypopygium wholly red, first segment thinly pale pollinose above, the second more shiny; forceps brownish, rather wide and straight in profile but thin on the divided apical two-fifths as viewed from behind; accessory process red, moderately large, with sparse hairs along front margin; penis rather short, its basal segment blackish behind and pale in front, distal segment subovate in profile with the narrowed median terminal part curved forward between two wider lateral processes, which are strongly incurved as viewed from behind; on each side in front near the base of apical segment is a small white plumose or featherlike appendage closely appressed and hardly visible in lateral view; posterior forceps moderately large, nearly straight tips flattened and rather wide; anterior forceps slightly heavier, directed forward from base, with a lobe on outer side before middle; fifth sternite yellow, divided apically, lobes largely retracted.

Length, 10 mm.

Holotype: Male, Franklin, Louisiana, April 23, 1938 (John Standish).

*Sarcophaga fortisa*, n. sp.

Fig. 15

Male.—Like the preceding species but closer to *S. sima* in genital features. Fourth abdominal segment and fifth sternite wholly black, lobes of latter with a dense fringe of black hairs on inner margin; hind tibiae with abundant villosity, middle pair bearing two anterodorsal bristles.

Hypopygium moderately large; first segment black, with a row of weak bristly hairs on hind margin; second segment large, globose, subshining red; forceps red basally, rather long, straight and thick in profile ending in a small incurved tooth, divided apically but not divergent in rear view; penis large, its stalk translucent white in front, with chitinated hind margin brown and deeply grooved; distal segment darker, globose, with a rather short median clawlike process extending forward over the hollow anterior side, from within which two pairs of small processes extend forward beyond the lateral rim of the segment (the latter are lacking in *S. sima*); on the front side of the apical segment a heavy process extends downward from the base then divides into two broad diverging arms slightly bowed to the rear; accessory process red, subtriangular, sparsely haired; anterior claspers directed forward from base, flattened and not strongly tapered; posterior claspers shorter, moderately bowed, tips flat, rounded.

Length, 12 mm.

Holotype: Male, Amherst, Ohio, July 14, 1926 (A. J. Barckert).

*Sarcophaga mimoris*, n. sp.

Fig. 16

A blackish feebly shining species, with three postsutural dorsocentrals; male hind tibiae moderately villose, second genital segment red.

Male.—Front at vertex 0.20 of head width, narrowed a trifle before ocelli thence widening rapidly into facial angle; parafrontals gray becoming darker near vertex; parafacials subsilvery, with minute hairs above and coarser ones below on outer margin; frontal rows moderately diverging anteriorly, two bristles beneath antennal base; ocellars small, inner verticals moderately stout, outer ones barely differentiated; antennae black, third segment about twice length of second and reaching lower fourth of face; arista long plumose to middle or beyond; vibrissae near oral margin; cheeks cinerous, black-haired, a little under one-third eye height; proboscis short; palpi black, stoutish; occiput with three rows of black hairs above and white pile at middle and below.

Thorax gray pollinose, the dark dorsal vittae not very well defined behind suture. Chatetotaxy: acrostichal, 0,1 (prescutellar well developed); dorsocentral 3,3; presutural 1 (outer); humeral 3; sternopleural 3; scutellum with 2 large lateral, 1 small decussate apical and 1 preapical pair; prosternum and postalar slopes setose; propleura bare.

Legs shiny black; mid tibiae with one anterodorsal bristle; mid femur without distinct comb; claws and pulvilli elongate.

Wings gray hyaline; first vein bare, second setulose over halfway to small cross vein; costal spine small but distinct; calypters white.

Abdomen black, with gray tessellated pollen above; first and second segments with only lateral bristles; third with one median marginal and three to five lateral pairs; fourth with a complete marginal row; fifth sternite mostly blackish, widely divided apically, inner edge of lobes fringed with black hairs.

Hypopygium moderately large, first segment grayish black, becoming brownish basally, second shiny red; forceps moderately thick and nearly straight in profile ending in a minute tooth, united nearly to apex as viewed from the rear, the broad flat basal part reddish and clothed with fine recumbent hairs; accessory process red, sparsely black-haired; penis with a rather slender basal stalk, brownish on hind side and translucent white in front; distal segment globose narrowed apically to a gently curved median beak; beginning at the base of the segment in front two processes extend forward, the anterior one small, tapering to a simple sharp tip, the posterior one larger and broadly recurved dorsally on the apex; claspers rather short and stout, anterior pair rather strongly flattened distally, with tips emarginate.

Female.—Like male, comparatively dark and subshiny in general aspect; front at vertex 0.25 of head width and equibroad nearly to antennal base; outer verticals and orbitals present; apical scutellars lacking; abdomen more thinly pollinose and shining above than in male; genital segments red, retracted, without larvipositor.

Length, 6-10 mm.

Holotype: Male, Amherst, Ohio, July 16, 1930 (H. J. Reinhard). Paratypes: 5 males and 1 female, same data as type, except two dated June 5, 1924.

### *Sarcophaga postilla*, n. sp.

#### Fig. 17

Close to *S. cessator*, to which it traces in Aldrich's key, but at once distinguished by the different structure of the internal parts of the male genitalia.

Male.—Front at vertex 0.26 of head width and barely narrower before ocelli; parafrontals and parafacials whitish to silvery pollinose, the latter almost as wide as clypeus, with the usual row of hairs on outer margin to middle thence scattered sparsely over most of lower half, none large or bristly; frontal rows sharply divergent anteriorly, two bristles beneath antennal base; outer verticals vestigial; ocellars small; antennae three-fourths length of face, black, second segment reddish on apex and about half as long as third; arista long plumose on basal three-fifths; vibrissae slightly above oral margin; cheeks cinereous, black-haired, nearly two-fifths eye height; proboscis short; palpi normal, black; occiput with three rows of black hairs on upper margin, thence wholly pale-haired downward.

Thorax rather densely gray pollinose, the median vitta above divided



into three narrower ones of which the outer stop shortly behind suture and middle one extends to apex of scutellum; anterior acrostichals two or three; prescutellars well developed; postsutural dorsocentrals three; sternopleurals three; scutellum with two strong lateral, one small decussate apical and one preapical pair; prosternum and postnotal slopes haired; propleura bare.

Legs black, basal segments gray pollinose; hind tibiae moderately villose; mid femur with three or four stubby spines on the ventral posterior edge near apex; mid tibiae with two anterodorsal bristles; claws and pulvilli elongate.

Wings hyaline; costal spine short; first vein bare, third with six to eight hairs extending nearly halfway to small cross vein; calypters white.

Abdomen black, gray pollinose, tessellated, with three somewhat changeable vittae visible in most angles; three basal segments with only lateral bristles, fourth bearing a complete marginal row; fifth sternite red, widely and deeply cleft at middle behind, the lobes small, retracted and fringed with black hairs along each diverging inner margin.

Hypopygium wholly red, rather large; first segment lightly pollinose, with a row of six to eight good-sized bristles on hind margin; second segment globose, moderately bristled and haired above; forceps red on proximal two-thirds, the united basal part behind concave and sloped forward, the free part moderately wide in profile terminating in gently bowed tips; viewed from behind the forceps beyond the basal curvature are divided but contiguous to apical third, from this point basad the inner margin of each prong bears a dense vestiture of pale, pubescent hairs; penis jointed near base only, its stalk rather slender in profile, divided distally into two slender simple-tipped processes which recurve apically enclosing a black soft padlike structure bearing minute stubby spines on the flat upper surface, from the inner extremity of the latter a pair of broad subtriangular processes extend forward and inward, these are shining reddish to brown and chitinated in texture; posterior claspers rather slender, straight, tapering to a sharp tip; anterior claspers very small and inconspicuous.

Length, 10-11 mm.

Holotype: Male, Costa Mesa, California, July 20, 1938 (J. G. Shanafelt). Paratype: 1 male, Oceanside, California, June 24, 1921, no collector's label.

#### *Sarcophaga cosmata*, n. sp.

##### Fig. 18

A medium-sized, black western species seeming close to *S. sarraceniae*, which I have not seen. The genitalia of the latter, as figured by Aldrich, show distinct differences from the present form.

Male.—Front at vertex 0.21 of head width and a trifle narrower before ocellar triangle; parafrontals and parafacials pale yellowish gray pollinose, the former appearing blackish on upper half in some views; frontal rows strongly divergent anteriorly, two or three bristles beneath antennal base; postocular fringe unusually long above, postocellars well developed; inner verticals long; ocellars small, divaricate, often one or more secondary pairs present; antennae back, third segment rather wide and hardly twice longer

than second, reaching to lower fourth of face; arista moderately long plumose to middle or beyond; epistoma short, bowed forward; vibrissae on oral margin; facial ridges haired to middle; parafacial with the usual row of hairs on outer margin becoming bristly below; proboscis moderately stout, haustellum a little longer than palpi, latter black; cheeks cinereous, moderately clothed with long black hairs, one-third eye height; back of head rather strongly bulged, pale pilose with several irregular rows of coarser black hairs on upper margin.

Thorax gray pollinose with five to seven black vittae above, rather strongly bristled. Chaetotaxy: acrostichal 0,1; dorsocentral 2 or 3,3; presutural 1 (outer); intraalar 2 (none near suture); supraalar 3; sternopleural 3; scutellum with 4 lateral (basal and intermediate one sometimes very weak), 1 good-sized decussate apical and 1 long preapical pair; propleura bare; prosternum and postnotal slopes setose.

Legs black, hind femur with three well developed rows of bristles on outer side, the preceding one without comb; mid tibiae with two anterodorsal bristles; hind tibiae with rather dense long hairs on entire length; claws and pulvilli long.

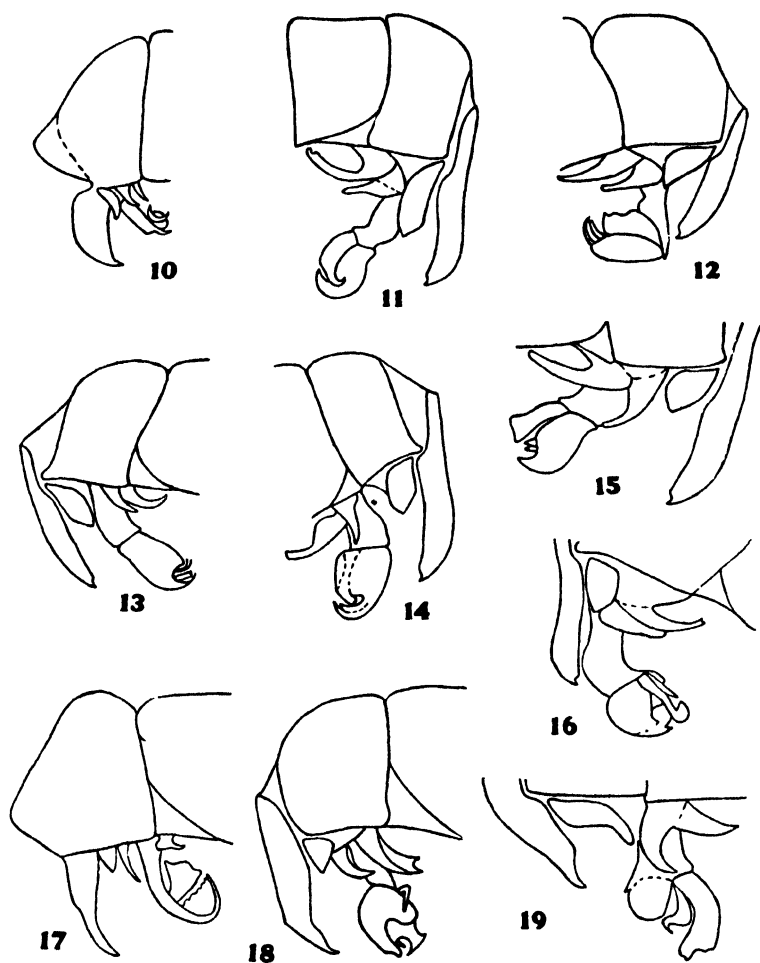
Wings subhyaline with a uniform light brownish shade except on hind margin; first vein bare, third setulose halfway to small cross vein; costal spine vestigial; calypters opaque white.

Abdomen gray pollinose, strongly tessellated above; wholly black in ground color; basal segments with only lateral bristles, third with a strong erect median marginal pair and three or four at side; fourth bearing a complete marginal row; fifth sternite largely retracted, the blackish lobes small and widely separated, with closely set black hairs on basal half of inner margin.

Hypopygium rather large; first segment polished black with hind margin more or less reddish and bearing a row of bristly hairs; second segment globose, shiny red, moderately beset with fine long hairs; forceps blackish, rather short and broad in profile, hardly narrowed to near tip thence sloping obliquely forward to the anterior apical extremity which ends in an acute tip; penis jointed near middle, basal segment brownish and deeply rooved on hind side, somewhat swollen and translucent white in front; apical segment globose with a short terminal apical beak curving forward between two lateral processes which curve back, the tips of latter are expanded and bear minute flat or scalelike hairs; near base and arising from the hollow front side of the segment a pair of small processes extend barely above the rim then turn angularly forward terminating as a delicate pale membrane; anterior clasper directed forward, tortate and concave on inner surface apically with broad tips deeply emarginate; hind forceps smaller, tapering to simple curved tips.

Length, 10-12 mm.

Holotype: Male, Fall City, Washington, June 9, 1932 (J. Wilcox). Paratypes: 2 males, Electron and Olympia, Washington, May 7 and 19, 1935. (J. Wilcox) and 1 male, labeled "Oregon, August 18, 1930."



Lateral View of Male Genitalia

## Plate II

- Figure 10 *Sarcophaga alopecis*, n. sp.  
 Figure 11 *Sarcophaga mendax*, n. sp.  
 Figure 12 *Sarcophaga elanis*, n. sp.  
 Figure 13 *Sarcophaga hesternia*, n. sp.  
 Figure 14 *Sarcophaga acadiana*, n. sp.  
 Figure 15 *Sarcophaga fortisa*, n. sp.  
 Figure 16 *Sarcophaga mimoris*, n. sp.  
 Figure 17 *Sarcophaga postilla*, n. sp.  
 Figure 18 *Sarcophaga cosmeta*, n. sp.  
 Figure 19 *Sarcophaga litorosa*, n. sp.

One female bearing the same data as the Oregon male, and apparently taken in company with it, may belong here. It has the same dark shiny habitus of the male, but there are only two lateral scutellars present, the middle tibiae bear three anterodorsal bristles, and the apex of the abdomen is red.

### *Sarcophaga litorosa*

#### Fig. 19

Allied to *S. setulosa* Wulp (*Boettcheria cimicis* Townsend), but the internal parts of the genitalia differ somewhat in structure and the heavy vestiture of long wavy hairs on hind side of forceps in *S. setulosa* is lacking in the present species.

Male.—Front at vertex 0.23 and at narrowest part (before ocelli) 0.20 of head width; parafrontals and parafacials pale yellowish gray pollinose, the latter with the usual row of hairs but set well in from lateral margin; frontal rows strongly divergent and three or four bristles below antennal base; outer verticals absent; ocellars slender; antennae black, third segment twice length of second and reaching nearly to vibrissae, which are on oral margin; arista with medium length plumosity for three-fifths its length; proboscis short, palpi black, with numerous hairs; cheeks subshining black, with thin gray pollen and long black hairs, one-third eye height; occiput wholly black-haired on upper half and pale pilose at middle below.

Thorax gray pollinose with the usual three to five black vittae above; anterior acrostichals developed, usually three but hind pair sometimes vestigial or absent; prescutellars very small and hairlike, often entirely lacking; three postsutural dorsocentrals (one specimen with four); three sternopleurals; scutellum with three lateral, one long decussate apical and one preapical; propleura bare.

Legs black; hind tibiae with long dense erect hairs, the preceding pair bearing one large and usually one small anterodorsal bristle; hind femur with two complete rows of stout bristles on outer side above middle and a partially developed row on lower edge beyond middle; mid femur without comb; pulvilli large, brownish.

Wings subhyaline, small cross vein slightly infuscated; third vein haired over halfway to small cross vein, first bare; costal spine vestigial; calypters white.

Abdomen rather long and narrow, with gray pollen above in a strongly tessellated pattern; third segment with a pair of stout erect median marginals and three or four laterals; fourth segment with a marginal row; fifth sternite red, bearing a pair of flattened or padlike structures at the base of the V-shaped cleft and immediately beneath these two short pale knoblike processes which are directed downward.

Hypopygium rather large; first segment red with basal half somewhat gibbus above and more or less infuscated, a row of small bristles before hind margin; second segment smaller, without bristles, wholly red; forceps red, short and broad in profile with the anterior edge sloping obliquely rearward narrowing the posterior extremity to a short curved beak; penis

with a short basal stalk, distal segment terminating in a rounded knob behind and bearing a long curved claw in front which divides apically into two diverging prongs, each ending in a soft irregular membrane; between the rounded posterior part of the segment and the base of the anterior claw a pair of small processes extend downward for half the length of claw thence bow rearward with the thin or flattened tips sharply recurved and their basal half concealed by a thin rounded membranous lobe which is not very conspicuous in profile; claspers ordinary, both pairs rather short and stout.

Length, 10-13 mm.

Holotype: Male, Sequoia National Park, California, August 6, 1940 (E. E. Kenaga), in the Snow Entomological Collections, University of Kansas. Paratypes: 14 males from California as follows: Yosemite National Park, August 1, 1940 (R. H. Beamer); Jamesburg, August 11, 1938 (D. W. Craik, Jean Russell); Pacific, August 9, 1940 (L. J. Lipvosky, R. H. Beamer); and Palm City, July 27, 1938 (Jean Russell). Seven males, Puyallup, Washington, May, June and September, 1933 (J. Wilcox).

*(To be concluded in October issue.)*

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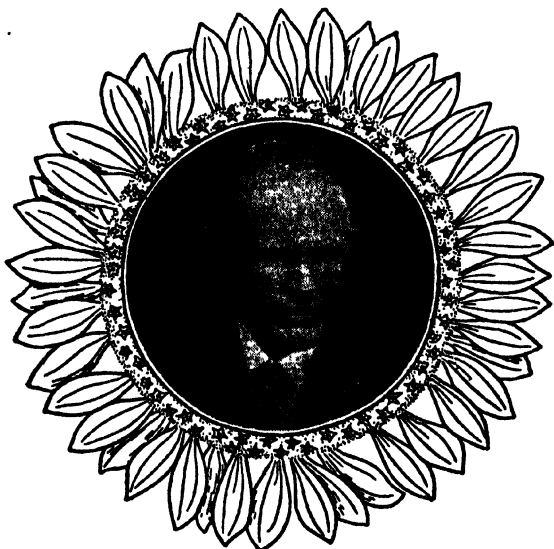
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**Vol. 20, No. 4, October, 1947**

*This issue mailed December 27*

## NEW NORTH AMERICAN MUSCOID DIPTERA

H. J. REINHARD  
College Station, Texas  
(Continued from July issue)

*Sarcophaga siccana*, n. sp.

## Fig. 20

Very similar to *S. litorosa*, differing only in the following characters:

**Male.**—More heavily pollinose or grayer in general aspect; front at vertex 0.20 of head width; antennae subequal length of face, third segment over twice length of second; cheeks with heavy cinereous pollen becoming yellowish above; prescutellar bristles absent; anterior acrostichals four, moderately large; hind femur with only a partially developed median row of bristles on outer side before apex; mid tibia with one anterodorsal bristle; wings hyaline, third vein with three to five hairs near base; calypters glassy white with a light brownish shade at middle of hind lobes; abdominal pollen with a distinct yellowish sheen on segments three and four, the latter showing an obscure reddish tinge in ground color.

Hypopygium rather small; first segment mostly red becoming darker at base, pale pollinose above, with an interrupted row of good-sized bristles before hind margin; second segment subshiny red, sparsely haired on upper surface; forceps red, rather narrow in profile on basal part, which bears a tuft of long hairs behind, widening to middle thence tapering rapidly to a short acute beak; penis with a short reddish basal stalk; distal segment enlarged, subquadrate in profile with a deep median emargination on posterior side; viewed from behind the hollow interior surface of the segment contains a minute median and a pair of delicate lateral processes which are not visible in profile; both claspers small; accessory process short and narrow.

**Female.**—Front 0.30 of head width, narrowest at vertex; the usual orbitals and outer verticals present; ocellars rather stout; apical scutellars absent; mid tibia with two anterodorsal bristles; last abdominal segment wholly red, with deep yellow to golden pollen; genitalia red, first segment prominent, evenly arched above and enclosing a flat subtriangular sternite below.

Length, 10.5-12 mm.

**Holotype:** Male, Sunnyside Canyon, Huachuca Mts., Arizona, July 7, 1940 (D. E. Hardy), in the Snow Entomological Collections, University of Kansas. **Paratype:** 1 female, Santa Rita Mts., Arizona, May 31, 1946 (R. Bohart).

*Sarcophaga vernilis*, n. sp.

## Fig. 21

Very close to *S. ampulla*, but with decisive differences in the male genitalia.

**Male.**—Front at vertex 0.21 of head width, slightly narrowed downward thence widening evenly into facial angle; parafrontals and parafacials silvery, the latter with a row of small hairs along outer margin; frontal

rows feebly divergent at antennae, one bristle beneath base of same; outer verticals differentiated; ocellars moderately large; antennae black, third segment two and one-half times second, reaching nearly to vibrissae, which are on oral margin; facial ridges setose to middle; arista moderately long plumose to middle or beyond; cheeks one-fourth eye height, with thick gray pollen and black hairs intermixed with pale ones on lower edge; proboscis short but not very stout, palpi black, normal in size; occiput with two rows of black hairs on upper margin and below latter wholly pale pilose.

Thorax rather densely gray pollinose, with three to five black vittae above; anterior acrostichals vestigial, prescutellars well developed; postsutural dorsocentrals three; sternopleurals three; scutellum with three lateral, no apical and one preapical pair; propleura and prosternum bare; postnotal slopes setose.

Legs black; hind tibiae not villose, middle pair with one stout and usually one small anterodorsal bristle; middle femur with a few stubby spines on apical posteroventral edge; claws and pulvilli moderately long.

Wings hyaline; costal spine small; first and third veins setulose; last section of fifth vein one-third length of preceding; calypters white.

Abdomen with rather thick gray pollen, tessellated, apical margin of fourth segment orange red; third segment with one pair of median marginals besides one or two laterals; anal segment with a complete marginal row; fifth sternite with a wide U-shaped apical incision, lobes small and largely retracted, inner margin of same clothed with pale pubescence and a fringe of delicate black hairs.

Hypopygium small, both segments red but first darker at middle of basal margin above, this area somewhat pruinose; forceps black, moderately long, somewhat constricted before apex, which is obtusely toothed behind and obliquely prolonged on anterior extremity; penis stalk red and rather short; apical segment enlarged, subovate in profile, brownish behind and partly translucent white on swollen front side, which bears a shallow emargination before the apex; in direct view the distal extremity of the segment is almost circular, hollow, and contains a number of very minute processes aside from the copulatory tube, which alone protrudes sufficiently to become visible in lateral aspect; accessory process small, brownish black; front claspers with a broad heavy base, curved and narrowed apically; hind claspers smaller, suddenly narrowed near middle, thence very slender ending in delicate curved tips.

Length, 6-9.5 mm.

Holotype: Male, Brewster Co., Texas, July 1, 1937 (C. E. Heard). Paratypes: 2 males, same data as type; and 3 males, Chiricahua Mts., Arizona, July 4, 1940 (R. H. Beamer and D. E. Hardy), in the Snow Entomological Collections, Kansas University.

***Sarcophaga sigilla*, n. sp.**

**Fig. 22**

Hind and middle tibiae with abundant long hairs, three postsutural

dorsocentrals and hypopygium mostly red. Traces to *S. tetra* in available keys, from which it differs widely in genitalic characters among others.

Male.—Front measuring 0.23 of head width before ocellar triangle and but slightly more at vertex; parafrontals and parafacials pale yellowish gray pollinose, the latter with a row of scanty hairs somewhat scattered above; frontal rows rather strongly divergent anteriorly, two or three bristles below antennal base; ocellars small; outer verticals not developed; antennae black, subequal length of face, third segment twice longer than second; arista long plumose on basal three-fifths; epistoma rather prominent, vibrissae on oral margin, clypeus cinereous, not much wider than parafacial; proboscis short, stout; palpi black, normal in size, cheeks cinereous tinged with yellow above, sparsely black-haired<sup>1</sup>, one-third eye height; occiput moderately bulged, with coarse black hairs above and finer pale ones below.

Thorax gray pollinose, with five to seven black vittae above, anterior acrostichals absent, prescutellar pair moderately long; sternopleurals three, scutellum with two lateral, no apical and one preapical pair, propleura and prosternum bare.

Legs black, hind tibiae somewhat reddish, mid femur without comb; mid tibiae bearing two anterodorsal bristles and less densely haired than hind pair; claws and pulvilli long, the latter brown.

Wings hyaline; costal spine not developed; first vein bare, third setulose over halfway to small cross vein, which is slightly infuscated; calypters white.

Abdomen black with gray pollen which is interrupted by three rather wide and fairly constant black vittae; third segment with one pair of median marginals and one strong lateral, fourth segment reddish on hind edge, the latter bearing a row of moderately long stout bristles, fifth sternite red, lobes small and widely divergent apically, the inner margin at base somewhat widened and thickly beset with stubby spines which extend distally but with finer hairs intermixed before the apex.

Hypopygium large, first segment brown on basal half or more, without bristles; second segment subshiny red, globose, with rather sparse, erect fine hairs above; forceps red on basal half, stout, bowed forward and tapering to acute shiny black tips, the latter slightly divergent in rear view; accessory process triangular, clothed with moderately long pale brown hairs; penis with a very short basal stalk, swollen and white in front; distal segment large, narrowed and curved forward apically with each lateral extremity of the apex moderately produced, immediately in front of the apical claw a pair of membranous processes extend forward to the apex of the same, on the front side near the middle the apical segment bears a pair of articulated triangular plates and basad of latter a larger cone-shaped protuberance, which has the front and apical surface beset with minute stubby spines, both claspers rather small, tapering to narrow tips.

Length, 11 mm.

Holotype: Male, Huachuca Mts., Arizona, July 8, 1932 (J. D. Beamer), in the Snow Entomological Collections, Kansas University.

*Sarcophaga prolepsis*, n. sp.

## Fig. 23

Belongs to Aldrich's Group D, characterized by having three postsutural dorsocentrals, hind tibia not villous and hypopygium at least partly red. The present species apparently is not closely related to any previously described form in the morphology of the genitalia.

Male.—Front at narrowest 0.20 and at vertex 0.25 of head width; parafrontals and parafacials silvery, the latter with a single row of minute hairs on outer margin; frontal rows moderately diverging at antennae, two bristles below base of same; antennae subequal length of face, second segment red, third concolorous near base, two to two and one-half times longer than second; arista moderately long plumose on basal half; outer verticals absent; ocellars normal in size; vibrissae strong, on oral margin; proboscis short, palpi black, rather slender, cheeks cinereous, wholly black-haired, one-third eye height; occiput with three irregular rows of black hairs above, pale pilose at middle and below.

Thorax gray pollinose with five to seven black dorsal vittae; anterior acrostichals small but differentiated, prescutellars small to medium-sized, sternopleurals three; scutellum with two large lateral, one small decussate apical and one preapical pair; propleura bare, prosternum and postnotal slopes setose.

Legs black; mid femur without comb, its tibia with two anterodorsal bristles; pulvilli large, brown, claws long.

Wings hyaline; first vein bare, third haired over halfway to small cross vein; costal spine vestigial.

Abdomen with rather heavy pale gray pollen, showing three fairly constant black vittae in most angles, third segment with a pair of median marginals and three to five at sides; fourth segment with a complete marginal row; fifth sternite red, with inner margin of the lobes at base of the U-shaped incision bearing a very dense vestiture of short black hairs, which become sparser outward but extend almost to apex.

Hypopygium rather small; first segment red tinged with black and pollinose at middle above, several good-sized bristles before hind margin; second segment more shiny, wholly red, without bristles; forceps shining brown, divided on apical three-fifths but not divergent, each prong shallowly grooved behind and bearing a sublateral carina on basal half; viewed in profile the hind margin of the forceps is broadly emarginate near middle thence evenly arcuate to tip; accessory process red, very small; penis with a short triangular basal stalk; distal segment slender in profile, bent rectangularly forward at middle, with a swollen lobe in front, which bears a short upcurved hook at each side on the apical extremity; near the apex behind the segment bears a strong bowed process, which divides apically into two slightly divergent blunt-tipped hooks; posterior forceps rather slender, tapering to sharp curved tips; anterior forceps sharply bowed near base thence strongly compressed to broad tips.

**Female.**—Like male except for the usual sexual differences. Genital segment rather small, flat at sides leaving a more prominent invetted V-shaped part visible in profile, the margin of the triangular orifice bears a fringe of bristly hairs.

Length, 7-11.5 mm.

**Holotype** male and allotype female, Chiricahua Mts., Arizona, July 4, 1940 (D. E. Hardy and R. H. Beamer), in the Snow Entomological Collections, University of Kansas. **Paratypes** 1 male and 2 females, same data as type; 1 male, Sunnyside Canyon, Huachuca Mts., Arizona, July 9, 1940 (D. E. Hardy) and 1 female, Santa Rita Mts., Arizona, July 19, 1938 (R. H. Beamer).

### ***Sarcophaga spretor*, n. sp.**

#### **Fig. 24**

Resembles *S. prohibita* Aldrich (*Acanthodotheca* Townsend) in all essential details except the genitalia, the latter are strikingly different.

**Male.**—Front narrower than usual, at vertex 0.18 of head width; parafrontals and parafacials silvery, the latter with a row of small hairs near eye; frontal rows moderately divergent in lower two bristles, which are beneath antennal base; second segment of antennae reddish, third darker, reaching four-fifths the distance to vibrissae, which are slightly above oral margin, arista long plumose on basal three-fifths, palpi red, rather slender; proboscis short, stout; cheeks gray pollinose, black-haired, one-third eye height; occiput pale pilose with three rows of coarse black hairs on upper margin.

Thorax gray pollinose, with five to seven black vittae above, anterior costichals well differentiated, prescutellar of medium size; postsutural dorsocentrals three; sternopleurals three, scutellum with two large lateral, one medium-sized preapical and one small apical; propleura with a few minute hairs in front of middle and prosternum with several on lateral edge behind.

Legs black, rather slender; hind tibiae not villose, preceding pair with two anterodorsal bristles; mid femur without comb; claws and pulvilli elongate.

Wings hyaline; costal spine small; third vein haired halfway to small cross vein; calypters white.

Abdomen gray pollinose, tessellated, with three rather distinct black vittae on entire length above; three basal segments without median marginals, fourth with a complete marginal row; fifth sternite mostly reddish, lobes thickly beset with black spiny hairs on apex and bearing a pair of ovate padlike structures on inner margin near base.

Hypopygium large, wholly red; first segment pale pollinose and sparsely fine-haired above, with a row of bristles on hind margin; second segment more shiny, with a heavier vestiture of black hairs, none bristly; forceps red and strongly bowed forward near base, the free part shining brown, divided but not divergent, rather straight in profile, tapering to sharp tips turned forward; accessory process red, gradually narrowed distally and

about twice longer than wide; penis extra large, jointed near base and middle, stalk red, slender; distal segment with a pair of recurved hooks on the hind side and the apex bearing a very large blackish hoodlike lobe, mostly soft in texture; the latter is moderately compressed and bears a vestiture of minute stubby hairs on lateral surface, near the base above a short chitinized process on either side supports a small transparent brown flaplike lobe, which is directed laterally and inconspicuous except in front or rear view; posterior forceps strongly compressed, gently bowed and directed forward from base, emarginate on upper edge before tip; anterior forceps short and inconspicuous, tips broad, obliquely truncate in profile view.

Length, 9.5 mm.

Holotype: Male, Logan, Utah, September 2, 1926 (George Knowlton).

*Sarcophaga reperta*, n. sp.

**Fig. 25**

Allied to *S. eleodis* Aldrich (*Eleodiomyia* Townsend) in genital features, but considerably larger and more robust in build.

Male.—Front at vertex 0.21 of head width and but slightly narrowed before ocellar triangle; parafrontals and parafacials silvery, the latter with one or more rows of small hairs near eye margin; frontal rows moderately divergent anteriorly, two beneath antennal base; ocellars normal in size, outer verticals absent; antennae reaching to lower fourth of face, second segment yellow apically, about half as long as third; arista long plumose on proximal three-fifths; vibrissae slightly above oral margin; facial ridges setose nearly to middle; proboscis short; palpi blackish, moderately long; cheeks cinereous, black-haired, barely one-third eye height; occiput pale pilose with three rows of black coarser hairs along upper margin.

Thorax gray pollinose, with five to seven black vittae well defined before suture; postsutural dorsocentrals three; anterior acrostichals well developed; prescutellars moderately large; sternopleurals three; scutellum with three lateral (intermediate one small), one preapical and one small decussate apical pair; propleura and prosternum sparsely haired.

Legs black; mid tibiae with two anterodorsal bristles, hind pair not villose; mid femur with comb; pulvilli large, brown.

Wings hyaline; costal spine small; first vein bare, third setose halfway to small cross vein; calypters opaque white.

Abdomen with rather heavy gray changeable pollen and showing the usual three shifting black vittae; third segment with one pair of median marginals, fourth bearing a complete marginal row; fifth sternite red, the lobes small and nearly contiguous along median incision, narrow apex of each lobe densely beset with stiff spiny hairs.

Hypopygium large, wholly red; forceps with a large flattened protuberance at base behind, thence deeply notched in profile, the distal part moderately wide and bowed forward, with minute spines on hind surface except at middle; accessory process pale red, large, convex on outer surface,

tapering apically to a blunt tip; penis with a short red basal segment; the apical one concolorous, somewhat thicker, with a pair of long recurved hooks near apex behind, from the base of the latter two slender divergent processes curve back thence inwardly under a somewhat thicker pair situated nearer to the anterior extremity of the segment; on the front side the segment bears a prominent lobe which appears attached on its distal half, but free and sloping obliquely forward towards base of the stalk; posterior claspers angularly bowed near base behind, strongly compressed on entire length, tapering to narrow tips; anterior claspers pale yellow, with a broad stout base, the short narrowed distal part curved forward and inconspicuous in profile.

Length, 11-12.5 mm.

Holotype: Male, Strawberry Mt., 8600 ft., Grant Co., Oregon, August 23, 1932 (D. K. Frewing). Paratypes: 1 male, Antelope Mt., 5000 ft., Grant Co., Oregon, August 8, 1932 (D. K. Frewing); 1 male, Roy, Washington, May 18, 1935 (J. Wilcox); and 1 male, "California, August 19, 1936." Three males in the Snow Entomological Collections, from California as follows: Cajon Pass, August 6, 1936 (M. B. Jackson) and Mt. Springs, July 25, 1938 (Jean Russell); and 1 male, Lone Pine, July 28, 1940 (R. H. Beamer).

***Sarcophaga complosa*, n. sp.**

**Fig. 26**

Male.—Characters like those of *S. reperta* except as follows: Front at vertex 0.24 of head width; vibrissae somewhat approximated and well above the oral margin; fourth abdominal segment usually reddish on hind margin; fifth sternite black, the lobes well separated, with inner margin of each near base of cleft bearing thick wedge-shaped process directed downward and prominent in profile; on the hind side these processes are flattened, pale in color and bear a sparse vestiture of ordinary fine black hairs.

Hypopygium smallish to moderate in size, red with first segment at times tinged with black on basal half above; forceps bulged at base in profile with deep incision immediately below, thence bowed back with the shining black free part spinose behind, rather short and broad curving forward to a sharp tip; viewed from the rear the forceps are widely separated and bear a sharp carina for their full length on the inner side; penis stalk red, the basal segment very short; apical segment with a pair of recurved hooks on hind side before apex and a simple slender process at each lateral extremity; on the front side the segment bears a pair of large articulated lobes, which are extended laterally on the apical margin in the form of thin brown earlike flaps, between the latter a separate and peculiar setose lobe extends obliquely forward and downward, in distal view the apical margin of latter is thin and inverted V-shaped; both claspers rather small, the anterior one more curved and stouter at base.

Length, 10.5-12 mm.

Holotype: Male, Mt. Springs, California, July 25, 1938 (Jean Russell), in the Snow Entomological Collections, Kansas University. Paratypes: 1 male, same data as type; 3 males from Arizona as follows: Tucson Mts., June



18, 1933 (R. H. Beamer), Santa Rita Mts., July 17, 1932 (R. H. and J. D. Beamer).

*Sarcophaga conabilis*, n. sp.

Figs. 27, 27A

Allied to *S. sulculata* Aldrich (*Zygastropyga* Townsend) but at once distinguished in the male by the much smaller hypopygium and the decisively different genitalia.

**Male.**—Front broader than usual, at vertex 0.30 of head width and equibroad to antennae; parafrontals and parafacials subsilvery, the latter with delicate hairs on outer margin; frontal rows only slightly divergent anteriorly, one bristle below antennal base; frontal vitta wide, rather heavily gray pollinose; verticals two pairs, well developed; orbitals absent; ocellars normal in size; antennae three-fourths length of face, second segment bright red, third blackish, about twice as long as second; arista moderately long plumose on basal half; vibrissae strong, near oral margin; cheeks heavily gray pollinose, black-haired, nearly two-fifths eye height; proboscis short, stout; palpi black, ordinary in size; occiput with coarse black hairs on most of upper half, a few pale ones around the neck and at middle below.

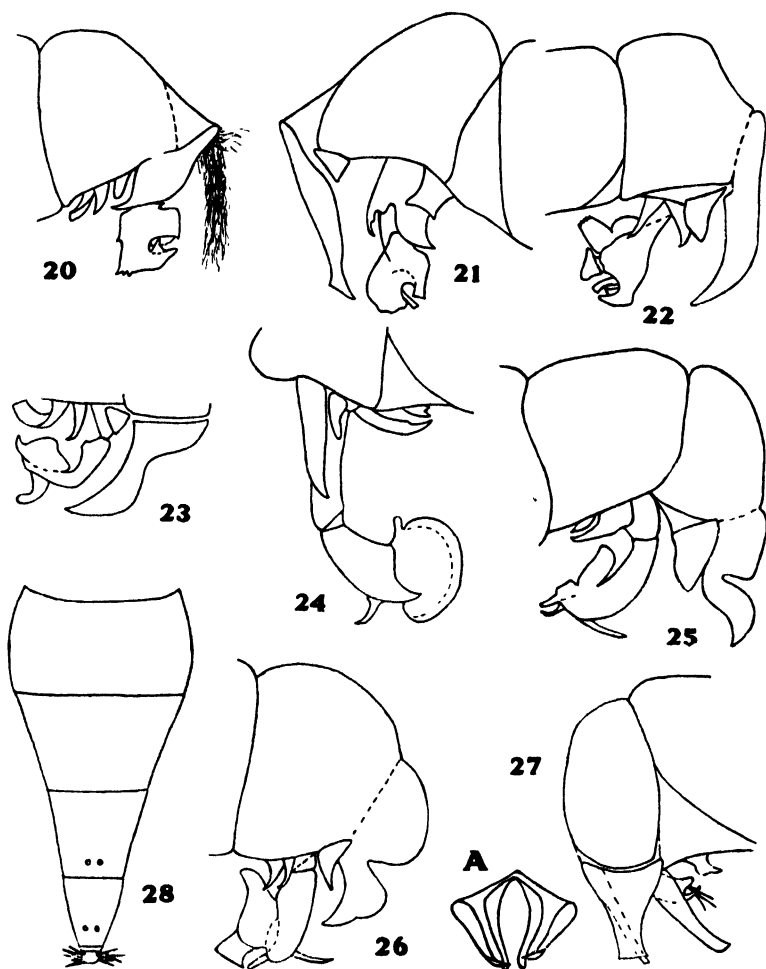
Thorax gray pollinose with three to five dark vittae above, the three median ones widest and showing a distinct brownish tinge in most views; anterior acrostichals two, well developed; prescutellars one, smallish but distinct; postsutural dorsocentrals four; sternopleurals three; scutellum with two lateral, no apical and one subdiscal pair; propleura, prosternum and postnotal slopes sparsely setose.

Legs black; hind tibiae with several long erect hairs on inner side, the preceding pair bearing one stout and one small anterodorsal bristle; mid femur without comb; claws and pulvilli elongate.

Wings hyaline; first vein bare, third setulose nearly to small cross vein; costal spine minute; calypters opaque white.

Abdomen gray pollinose with three rather distinct dark vittae above; third and fourth segments each with a marginal row of good-sized bristles; fourth segment red on narrow hind margin; fifth sternite with a broad U-shaped apical incision, the lobes small, reddish and sparsely clothed with fine hairs along inner margin.

Hypopygium moderately large, red, the first segment largely retracted, bare above except on darker hind margin, which bears a row of longer bristly hairs intermingled with smaller ones; second segment larger, slightly pruinose, sparsely clothed with short erect hairs; accessory process red, extra large and in lateral view covering the forceps except at their extreme tips; in rear view the forceps are rather widely separated, slender and gently bowed inward apically, tips bluntly rounded; posterior clasper shiny brown, also unusually large, directed obliquely forward and tapering gradually to a blunt tip; anterior clasper pale yellow, with a stoutish base thence narrowed into small forwardly directed hooks; penis short, bowed forward from base, emarginate at apex, the upper lobe of latter heavier and soft



## Lateral View of Male Genitalia

## Plate III

- Figure 20. *Sarcophaga siccana*, n. sp. Male genitalia lateral view.  
 Figure 21. *Sarcophaga vernilis*, n. sp. Male genitalia lateral view.  
 Figure 22. *Sarcophaga sigilla*, n. sp. Male genitalia lateral view.  
 Figure 23. *Sarcophaga proleptis*, n. sp. Male genitalia lateral view.  
 Figure 24. *Sarcophaga spreter*, n. sp. Male genitalia lateral view.  
 Figure 25. *Sarcophaga reperta*, n. sp. Male genitalia lateral view.  
 Figure 26. *Sarcophaga complosa*, n. sp. Male genitalia lateral view.  
 Figure 27. *Sarcophaga conabilis*, n. sp. Male genitalia lateral view.  
 27A, forceps and accessory processes in rear view.  
 Figure 28. *Sarcophaga compressa*, n. sp. Abdomen of female in dorsal view.

in texture, bearing three pale brown bristles on the lower apical edge, which extend forward between the diverging sharp tips of the more strongly chitinized hind part, the latter is divided on the median line for half the distance to the base, each part thin or bladelike as viewed from the rear.

Length, 9-9.5 mm.

Holotype: Male, College Station, Texas, March 21, 1945 (H. J. Reinhard). Paratype: 1 male, same data except dated May 15, 1943.

***Sarcophaga compressa*, n. sp.**

**Fig. 28**

Female.—With abdomen very strongly compressed and consequently unusually narrow as viewed from above. The remaining characters seem ordinary and similar to *Sarcophaga*, where the species may be assigned pending discovery of the male. Front at vertex 0.32 of head width gradually widening to antennae; parafrontals and parafacials gray pollinose, the latter with a row of coarse hair on outer margin; frontals moderately diverging in two bristles below antennal base; two strong orbitals and verticals; antennae three-fourths facial length, second segment red on apex and about one-half length of third; arista moderately long plumose on basal half or more; vibrissae stout, slightly above oral margin; cheek grooves red, this color extending upward to include inner half of parafacial to antennal base; palpi rather slender, black; proboscis short; cheek with gray pollen and coarse black hairs, one-third eye height; occiput with sparse pale hairs at middle below extending upward around neck thence wholly black-haired.

Thorax gray pollinose with five to seven black dorsal vittae; anterior acrostichals small but distinct; prescutellars moderately large; postsutural dorsocentrals three; sternopleurals three; scutellum with two lateral, no apical and one subdiscal pair; propleura practically bare; prosternum and postnotal slopes faintly haired. moderately long.

Legs black; mid tibia with two anterodorsal bristles; claws and pulvilli moderately long.

Wings hyaline; costal spine small; first vein bare, third setose nearly to small cross vein; venation ordinary, veins including costa yellow; calypters opaque white.

Abdomen strongly compressed and tapering sharply to apex from base of second segment, in profile unusually deep and moderately arched above, wholly gray pollinose with a distinct median vitta; three basal segments black, third bearing one pair of erect median marginals besides one or two differentiated laterals; fourth segment wholly red, with one pair of median submarginals and three or four smaller bristles at sides nearer margin; first genital tergite narrowly exposed, with several forwardly curved bristles on sides; two apical sternites shining red, rather long and directed obliquely upward, the last bearing heavy laterally directed spines on each side near apex.

Length, 10 mm.

Holotype: Female, Bexar Co., Texas, June 26, 1931 (H. J. Reinhard).

## THE GROUSE LOCUSTS

(Orthoptera; Acrididae: Tetriginæ)<sup>1, 2</sup>

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Several names have been applied by a number of entomologists to the Orthopteran sub-family **Tetriginæ**. Linne (1767) used the term **Bulla**, accompanied by unmistakable figures. Scudder (1900), Hancock (1902), and other orthoptologists have employed such words as **Tettix**, **Tettiginæ**, **Tettigidae** and **Tetriginæ**, which were apparently derived from the Greek word "tettix", meaning grasshopper. They are commonly called grouse locusts, probably because of a fancied resemblance to the grouse (**Tetraoninae**). They are also referred to as the pygmy or swamp locusts.

The **Tetriginæ** are among the smallest of the Orthoptera. The extremely developed apical process of the pronotum extends backward over the meso- and metanotum, and either to the end of the abdomen which coincides with the distal ends of the femora of the jumping legs, or considerably beyond. There is a tendency toward rather strict dimorphism with respect to the lengths of the pronotum and wings, although intermediate lengths are sometimes noted. The short pronotum and wings are nearly always the same length while the wings of the long phase protrude slightly beyond the apical end of the pronotum.

The individuals bearing long wings and pronota are able to fly readily and sometimes for long distances. Those bearing short wings and pronota are unable to fly and are thus restricted to jumping and walking movements. Pulvilli are lacking and the tegmina are greatly reduced or absent. They vary considerably in size, even within the species, and enormously within the sub-family. The males are usually conspicuously smaller than the females.

In the **Tetriginæ** the caeca have only anterior prolongations, while in the other **Acrididae** the caeca have each a smaller posterior extension as well. The crop is smaller and less rectangular anteriorly than in other **Acrididae** (Hancock, 1902; Robertson, 1915; Nabours, 1929). Other features of the internal structures are noted in the description of the reproductive systems (Robertson, 1915; Harman, 1925; Nabours, 1929).

The color patterns on the pronotum, legs and other parts of the body, even within a species, vary extraordinarily. There are several kinds, colors, and widths of stripes along the median pronotum and on the femora of the jumping legs, eight or ten observed conspicuous spots about the middle of the pronotum, and numerous other patterns. The colors of the patterns vary through white, gray, brown, yellow, mahogany and black and in many shades and combinations. More than 25 elementary dominant patterns and a few recessives have been observed in **Paratettix texanus** Hancock, upwards of

<sup>1</sup>Largely from previous and forthcoming papers by the author and colleagues.

<sup>2</sup>Contribution No. 251, Department of Zoology.

20 in *Apotettix eurycephalus* Hancock, and more than 25 in *Acrydium arenosum* Burmeister (Nabours, 1914, 1917, 1925, 1929; Nabours, Larson and Hartwig, 1933).

These elementary color patterns totaling more than a hundred so far observed in several species, most of them having been bred in the greenhouse, are, with perhaps less than a dozen exceptions, dominant in their inheritance. No interspecific crossing, following Hancocks taxonomy, has been accomplished. However, there are great possibilities for combining in the inheritance experiments, within the species, the various dominant elementary patterns so that each component pattern may be recognized, with the hybrid pattern still distinctly different (Nabours, 1929, plates III and IV).

Several of the dominant color patterns are repeated in different genera and species. There is a mottled gray-all-over pattern, recessive to most of the conspicuous patterns, common to nearly all of the species studied. It has been designated in the experiments as +/+ (old A). It is now considered the 'wild-type' (Nabours 1925; 1929). The pattern C in *P. texanus* has a counterpart in *Telmatettix aztecus* and *Nomotettix* (sp). The K-stripe of *A. eurycephalus* is almost exactly repeated in *P. texanus* and *A. arenosum*. However, these patterns are generally quite easy to distinguish among the species. There are also differences in the linkage relations of similar patterns in different species. For example, genes for color patterns designated as Y and K in *A. eurycephalus* are linked to the extent of approximately six percent; whereas J and K, their almost precise counterparts in *P. texanus*, exhibit no crossing over. Several other similar cases may be noted among the data (Nabours, 1925, 1929; Nabours, Larson and Hartwig, 1933).

According to Hancock (1902), the distribution of the *Tetriginae* is cosmopolitan for the tropics and the temperate zones. The greater numbers and varieties of species appear to be in the tropics, and more actual species are found in North America than in Europe. Hancock described 99 species for North America and he thought there were more. Hancock's classification has been employed in the extensive experiments at Kansas Agricultural Experiment Station because it has been considered more consistent than revisions which have been suggested.

For example, it has not been found that any of Hancock's species, so far used, would interbreed; whereas others have placed some of his non-interbreeding species in the one species. Hancocks *Paratettix texanus* and *P. cuculatus*, which do not interbreed, have both been placed in the one species and the name *P. cuculatus* retained, and his *Apotettix eurycephalus* and *A. mexicanus* which also do not interbreed have been accorded the designation of *A. mexicanus* (Letters to the author). These species appear to the experienced investigator as also differing in other aspects. However, we have not been concerned with the taxonomy so much as with the use of phenotypes as chromosome markers. This is not to minimize the importance of taxonomy. A thorough revision of the genera and species of the *Tetriginae* is very much to be desired.

Please note that the ill-advised (at the suggestion of others and only



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with Hancock's reluctant acquiescence) attribution of species to color varieties in *Paratettix texanus* by Nabours in 1914 has been definitely repudiated by him (1917) no less than by others.

The grouse locusts commonly inhabit moist areas, usually along the margins of streams, fresh water lakes and ponds. They have not been found by us in salt marshes, or any place affected by sea water. Some species, as *Tettigidea parvipennis* and *Acrydium arenosum*, generally inhabit moist grassy or wooded areas. These two species have a range extending at least from Manhattan, Kansas to San Antonio, Texas, the former having been collected also at Monterrey and Tampico, Mexico. Other species, as *P. texanus*, *P. cuculatus*, and *A. eurycephalus*, are more frequently found in open areas, along the algae-covered margins of ponds, especially as the water recedes in the summer and fall. The one conspicuous exception has been the collection of *P. texanus* and *A. eurycephalus* in considerable numbers in the rather densely wooded area along the north shore of Chicon Lake, 30 miles west of San Antonio, Texas. They were there on three different occasions, two and three years apart, along with *Acrydium arenosum* and *Tettigidea parvipennis* which were, as stated above, in their normal habitat.

The grouse locusts feed mainly on the various algae growing on the moist soil or the filamentous algae left by receding waters of ponds and lakes. However, with all our experience, it has not been ascertained whether the living algae supply nourishment or that the accompanying decayed algae and other vegetable matter and humus, fungi, bacteria, and protozoa are utilized. Breakfast foods, fruits and other materials have been tried without avail. Algae in various stages of life and decay are made available to them in the breeding cages. It has been noted that when green algae was fed to them the fecal pellets tended to be still quite green. None of the individuals of the species of the *Tetriginae* used in the experiments has eaten grass or higher plants to any extent.

The northern grouse locusts (generally from a line somewhat south of the Ohio, lower Missouri and Kansas Rivers) produce approximately one and a half generations a year, with only one along the northern U. S. A. border. The cold weather, arriving in October-December, catches them as adults and in various nymphal stages, and they all go into hibernation for the winter. They get into tufts of grass, under leaves, stones, and pieces of wood and often remain completely exposed. They probably receive little protection from the weather. They have been known to endure subzero weather. The mortality during the winter is high, due perhaps as much to desiccation as to low temperatures.

There is no regularity about their going into or emerging from hibernation. They do not become inactive until the cold weather actually arrives, and they become active again during warm periods. During unseasonable, early warm weather in February, in the region of Manhattan, Kansas, they emerge from hibernation, then go back into inactivity as the cold weather returns. As spring arrives, in the northern regions, the adults mate and lay their eggs during several weeks, in March, April or May, depending on the latitude and season.

The nymphs that hibernate over the winter contemporaneously become adults, mate and lay eggs some weeks later. It is our supposition, supported by observation and experimental breeding, that the adults, hibernating over a winter, produce a generation many individuals of which, in turn, give a second generation which pass the following winter as nymphs. The contemporaneously hibernating nymphs, maturing and laying eggs considerably later in the spring or early summer, give offspring which become adults in time for the coming winter—a sort of irregular alternation of hibernating generations, the one as adults, the other as nymphs, and a generation in the summer of every other year which does not go through the winter. Such availability of both adults and nymphs the year round may facilitate their survival through the severe meteorological and other hazards of environment.

### Scheme of Alternation of Hibernating Generations of Northern (U.S.A.) Grouse Locusts (Tetriginae)

(From the author in Bibliographia Genetica V, 1929.)

Winter	Spring	Summer	Autumn	Winter
ADULTS produce	NYPHPS become	ADULTS produce	NYPHPS remain	NYPHPS
NYPHPS become	ADULTS	NYPHPS become	ADULTS remain	ADULTS

In southern Texas and Louisiana the species *T. parvipennis*, *P. texanus*, *A. eurycephalus*, *Telmatettix aztecus* and others are active the year round except at times when the temperature is below 50°-60° F. Thus they differ from the northern species and members of the same species (*T. parvipennis* and *Acrydium arenosum*) in that they do not spend so much inactive time each year. They undoubtedly produce more generations in the south than in the north, depending on the latitude. At Baton Rouge, La., males and females of *P. texanus* were completely inactive early on a frosty February morning when the temperature was below 50° F., but were actively feeding and copulating by 3:00 p.m. when the temperature had gone up above 70° F. in the shade.

There is the difference, however, between the southern Louisiana to Tampico, Mexico, species and those of Manhattan, Kans., and Chicago, Illinois, in that the southern grouse locusts do breed during the winter in the northern green houses, although not so well as in the spring and summer; whereas, the northern ones will not breed at all until late winter, and then much better after a period of hibernation in a cold environment. It has been possible to secure an extra winter generation of *A. arenosum* from Manhattan, Kansas, by means of artificial light. Both mercury vapor and ordinary white bulb light were employed and proved effective. This is a field which should be further exploited (Sabrosky, Larson, and Nabours, 1933).

Some northern (region of Chicago) species of *Tettigidea*, *Paratettix*, and *Acrydium* were first used in the experimental breeding (1906-1908). They gave only one or, at best, one and a half generations a year. They would not breed during the fall or winter, even in the warm greenhouse. It was, therefore, decided to secure some southern members of the sub-family which, it was thought, might find the environment of the greenhouse more like that to



which they had been accustomed in nature. In September, 1908, specimens of *Paratettix texanus* were collected in the region of Houston, Texas. They were bred in a greenhouse of the University of Chicago for an average of four succeeding generations a year. Although they slowed down in the winter, their activities did not wholly cease.

The stocks were removed to the Kans. Agric. Expt. Station, Manhattan, in 1910, where the experiments have since been in continuous progress. Additional specimens of this and other species have been collected at Many, La.; Beaumont, Houston, Sugarland, San Antonio, Austin, College Station, and Brownsville, Texas; Monterrey, Tampico and Vera Cruz, Mexico, on some 30 other expeditions during the ensuing 37 years.<sup>3</sup> Specimens of *Apotettix eurycephalus* for experimental breeding were first collected at the village of Tamos, near Tampico, Mexico, in August, 1911. Specimens of this and other species have been added from the various areas in Texas and Mexico during each of the subsequent collecting trips.

*Apotettix eurycephalus*, *Paratettix texanus*, *Tettigidea parvipennis* and *Telmattettix aztecus* from southern Texas and Mexico, with a few of the latter from Pasadena, California, have been bred in considerable or large numbers in the order given (See bibliography). *Acrydium arenosum*, from the region of Manhattan, Kansas, have been employed to a considerable extent, although they give only one, or at best, two, generations a year (Nabours, Larson and Hartwig, 1933; Sabrosky, Larson and Nabours, 1933).

Compared with the species of *Drosophila*, the breeding of the grouse locusts is most arduous. Two of the four generations a year of the southern species and varieties are grown during an optimum period, approximately March to June, inclusive; while the other two generations are drawn out over the long period of about eight months, from July to February. The mortality is high at all times but especially bad during the periods of their slow growth. All the stocks except *T. parvipennis* died in the summer of 1936, due probably to disease-causing fungi, although protozoa were also found. The disease was apparently progressively sponsored by the extreme darkening of the greenhouses to lessen the severity of the extended hot weather of the summers of 1934, 1935, and 1936.

The cages used consist of 9 x 15 inch Pyrex or other well annealed glass cylinders set in bulb pots, partly filled with sand at the bottom and loam as rich as possible with humus on top. A 3 or 4 inch pot, with the hole plugged, is placed upside down over the hole in the bulb pot before the sand and loam are put in. This inside pot supposedly provides for the aeration of the soil. The food, consisting of algae and decayed vegetable matter, is best placed on the projecting bottom of the inverted pot and allowed to run down over part of the soil. The cylinders have covers made of 20-24-mesh screen wire (Nabours, 1914, 1937; Needham, 1937).

A male and female are mated in a cage and the eggs are laid in the ground. Soon after hatching, the young are transferred by means of a suction

<sup>3</sup>Two of the more extensive exploratory and collecting excursions were provided for by grants-in-aid by the National Research Council (1933) and The American Academy of the Arts and Sciences (1937).

machine (Needham, 1937) to new cages where they remain until records of the color patterns are made. The color patterns are distinct from the beginning, but records can be made better during the 3rd or 4th instars. To wait longer entails considerable losses in records since the mortality is continuous and rather large. For mortality tables of *A. eurycephalus*, see Nabours, Kans. Tech. Bul. 17 (1925).

Individuals often live in the laboratory four to six months. The oldest recorded life-span was that of a female which lived a few days more than nine months. After the records are made all, except those reserved for further mating, are preserved in 95 percent alcohol. After a change of alcohol the vials are hermetically sealed with a torch. The mated individuals, after the eggs are deposited, are similarly preserved when they do not die prematurely and become decomposed. In this way, up to a recent counting, 416,795 specimens had been conserved in 46,833 vials. In addition, several thousand miscellaneous specimens from various areas, ranging from Manhattan, Kansas, to Vera Cruz, Mexico, have been preserved.

The alcohol constitutes a superb preservative. Specimens killed not too soon after an ecdysis exhibit the color patterns and other features excellently after 35 years. Robertson found that the tissues and even the chromosomes of specimens preserved for years were available for histology and gross cytology. This rather extensive and conveniently arranged collection of pedigreed specimens of several species of the *Tetriginae* is very useful for checking with the cytogenetic records. There are parents and offspring, both adult and nymphal, extending from those collected in nature for more than 100 generations in sequence. All of them are catalogued in relation to the more than 27,000 pages of original records.

In addition to the conserved bodies of the insects, as noted, there are more than 5,000 superb microscopic slides of testes, ovaries, fertilized and partheno-developing eggs and somatic tissues. Many of the slides are of tissues and the various stages of the germ cells bearing x-ray induced anomalies. A large number of the slides are from near to remote pedigreed progenies of males, some of the functioning chromosomes of whose sperms had been affected by irradiation. Each of the slides refers to the exact position in the records (Kans. Tech. Bul. 17, 1925 and forthcoming Bulletin) where the specimen belonged, and many of the bodies from which the tissues were taken are still available (For descriptions of reproductive systems and spermatogenesis, see Harman, 1920 and 1925). All of the slides were prepared by or under the direction of our late colleague, W.R.B. Robertson.

Pairs of *Tettigidea parvipennis* occupy hours and even days in copulation during the period of egg-laying which may last several weeks. The males and females of *Apotettix eurycephalus* are at the other extreme, since they rarely require more than five to ten minutes at a time for mating. Pairs of *Paratettix texanus* spend from 10 minutes to more than an hour at times in copulation. The following concerning courtship and mating has been summarized from the observations on *Tettigidea parvipennis*, *Acrydium granulatus* and *A. obscurus* by Hancock, 1902, and Nabours, 1929.

The male approaches the female with a hurried, tremulous or sometimes jerky gait, and climbs upon her from the side, at times facing temporarily in the reverse direction. The males occasionally climb up on each other but appear soon to realize their mistakes. At the sight of an individual of another species or what appears to be an uncongenial male, the female usually shakes her body in a way that apparently indicates aversion. In the genus *Acrydium*, there is no anatomical provision for the male to clasp the female, so that the pairs cannot go about in copulation for long periods as can pairs of the genus *Tettigidea*.

After establishing himself on the female, when *T. parvipennis* mate, the male extends his posterior abdomen down below that of the female and to one side, and turns up the end so that the subgenital plate is affixed by its anterior border to the process of the last sternum below her ovipositor. In the meantime the female usually offers some opposition and the male goes through a kind of convulsive orgasm. After copulation the ovipositor is made to open and close repeatedly as if to facilitate the entrance of the semen.

When ready to oviposit, the female selects a suitable spot on the medium muddy ground or vegetable mould (*Paratettix*) or among moss and lichens (*Acrydium* and *Tettigidea*). The abdomen is curved under and the four gonapophases are forced into the ground. They spread and close and the abdomen turns back and forth on the long axis and thus makes its way into the ground. During oviposition the front and middle pairs of legs are raised while the hind legs are drawn up to the sides, so that the abdomen extends into the ground to its maximum depth. However, there is considerable diversity in the positions assumed during egg laying; in some species, as *A. eurycephalus*, the female rests in almost normal standing position, the abdomen extending only slightly into the ground.

When first laid the pod of 15-20 eggs is white with a tinge of pink; they later turn to a more opaque, greenish, yellowish-white. Hancock ascertained that the diameter of the eggs of *Acrydium ornatus triangularis* is one-third the length of 1.75 mm., not counting the micropylar extension. The eggs of *A. eurycephalus* are approximately 2.1 mm. in length; those of *P. texanus* are slightly larger, while *T. parvipennis* have eggs that are still larger, the total length being about five times the diameter. The period of the egg stage, between oviposition and hatching, varies widely, the extremes noted ranging from 15-30 or more days.

According to Hancock (1902), polyandry is frequent among the *Tetriginae*, especially in the species of *Acrydium* (The *Tettix* of Hancock) and others that spend short and frequent intervals in copulation. Those that require longer periods at a time for mating, as the genus *Tettigidea*, are more likely to be restricted to the one male for each female. Polyandry has been frequently noted among *Paratettix texanus*, *Apotettix eurycephalus* and others during the 41 years of their experimental breeding.

A special experiment with *P. texanus* was carried out in 1923-24 by Caroline Perkins, E. H. Ingersoll and the author (Nabours, 1927). We found

that as many as seven males placed with one female, concurrently, during a period of 14 days shared respectively in the parentage of her 102 offspring. The last male or males copulating with a female tended to become the parents of the predominant proportion of her offspring. The sexual products of none of the males appeared to have any effect on the observable characteristics of the progeny of any other males of the polyandrous matings.

The chromosome number was first ascertained in *Choriphyllum* (one species), *Nomotettix* (one species), *Acrydium* (four species), *Paratettix* (two species) and *Tettigidea* (two species). In the 10 species of these five genera, both the prematurated germ as well as somatic cells contained the uniform number of 13 for the  $2n-1$  of the males and 14 for the  $2n-2$  of the females. One fundamental plan of structure appears to run through the entire subfamily. The chromosomes are so regular and dependable in size gradations in all these genera and species of the *Tetriginae* that it is possible to recognize every one of the series of six autosome pairs as well as the sex chromosomes. Pairs numbers 2, 3, 4 or 5, for instance, are found to have about the same size, shape and relations in any species of the various genera (Robertson, 1915; see also Harman, 1915, 1925; several papers by Robertson, and those jointly by Nabours, Stebbins and Robertson.)

### Inheritance Experiments

The sub family *Tetriginae* have an extraordinary range and variety of color patterns, many of them conspicuously diagram-like. Most of the patterns are, as already stated, dominant to a mottled gray common to nearly all of the species. There are a few in *P. texanus* and *T. parvipennis* and one so far discovered in *A. eurycephalus* which are recessive to the common mottled gray "wild type" as well as to the series of dominants. Neither excessive temperatures, degrees of aridity, humidity, acidity and sunlight, irradiations, colors of soil, pots, foods, diseases, nor any other observable properties of the environment, however applied, have modified these color patterns to an appreciable extent, or in any way altered the color characteristics of the progenies. Such changes in the inheritance of the patterns and other aspects as occurred were referable to a few spontaneous mutations and certain fortuitous alterations of the chromosomes produced by means of drastic exposure to x-rays (See bibliography for papers and illustrations by Nabours, 1914, 1917, 1919, 1925, 1927, 1929; Bellamy, 1917).

From the inception of the cytogenetical studies of the grouse locusts in the University of Chicago, in 1906, and during the subsequent long period of experimentation in the Kansas Agricultural Experiment Station, the extraordinary, diagram-like dominant color patterns have been regarded as markers for the genes. It is regretted that more attention has not been given to such aspects as their taxonomy and ecology. They would make excellent material for such studies. Although many habitats have been explored, at least cursorily, and nearly a half million specimens conserved, the unexploited fields are still extensive, mostly swampy, teeming with mystery and problems and alluring to the real adventurer.

A project in genetics which employs such uneconomic organisms as the grouse locusts (*Tetriginae*) may be justified and supported by the director of the Agricultural Experiment Station for very good reasons. The principles and practices thus more economically derived and clearly defined are essential to a better understanding and application of the laws of heredity and the relations of the environment and other aspects of the biology which pertain to husbandry, sociology, medication and restoration. This is the plan of procedure in medicine and surgery wherein new agencies and methods are discovered and tried out thoroughly with planaria, other invertebrates, mice by the hundreds of thousands, great numbers of rats, guinea pigs and dogs. The principles and facts are thus tested under the most critically scientific circumstances before they are applied to healing and the treatment of the diseases of the useful domestic animals and man.

The following resumé of the principal results of the cytogenetic experiments with the grouse locusts and observations has been derived, as have most of the statements in this paper, from the publications of the author and colleagues, and the manuscript of an extended monograph by Nabours and Stebbins (1947). The numbers in parentheses refer to the paper listed in the Bibliography:

1. Classification, distribution and habits in nature (5-19).
2. Methods of experimental breeding (9, 18, 30).
3. Description of the characteristics: There are more than 100 all-over and diagram-like, generally dominant and few recessive, conspicuous color patterns, a lethal, the dimorphism of wing and pronotum lengths, and several teratogenic aspects (9, 13, 14, 16, 17, 18, 25, 26, and MS.).
4. Crossing over of genes occurs practically exclusively in the females of *A. eurycephalus* (15, 17), but in both males and females (though not equally in *P. texanus*) of other species (18, 25).
5. There is the extraordinary situation of close linkage of all 21 genes for color patterns and the lethal on one pair, the smallest, of the autosomes in *A. eurycephalus* (17, 18, 24). In *P. texanus*, 24 of some 26-30 conspicuous, dominant color patterns have their genes so closely linked on the one (as yet unidentified) pair of autosomes that only two have exhibited crossing over during extensive breeding (14, 18). In *A. arenosum* and *T. parvipennis*, the genes for the color patterns are more widely distributed among the pairs of autosomes; and crossing over occurs in the gametogenesis of both males and females (3, 25). No sex-linked characteristics have been discovered except the one x-ray induced, noted in item 10-15 (29). Summaries of the crossing over data, with revised and extended maps of the genes which condition the color patterns, the lethal and the x-ray translocated genes in *A. eurycephalus* are available (17, MS.).
6. A lethal gene in *A. eurycephalus* by some as yet unknown means abruptly killed those individuals homozygous for it at the stage some 3-4 days before time for hatching. The single dose of the lethal

made the heterozygotes significantly more viable and perhaps more vigorous than the sibs homozygous for the normal allele. It appears that the death-dealing gene in double or homozygous quantity and potency provided for some sort of deleterious activation or retardation which caused death before time for hatching; whereas, the amount and efficacy of the single or heterozygous gene functioned favorably to vigor and viability beyond that available for the normal sibs (26, MS).

This phenomenon is not without parallel in other organisms Gustafsson (1946) has presented a comprehensive review of the work of several authors. He concludes "that mutations lethal in homozygous condition may increase viability when they occur in the single dose (and) vigor may also be affected in a general sense." It is suggested (Nabours and Stebbins in Manuscript) in this connection, that there is nothing inherent in lethals, per se, that provides for an occasional one to function in the heterozygous amount and potency discretely favorable to vigor and viability. In contrast, certain lethals, such as 'creeper' in fowls, are distinctly deleterious in the heterozygous quantity and consequence. No one lethal, as among genes in general, is probably exactly like any other with respect to its effects either in the  $n$  or  $2n$  amount. There are, perhaps, many kinds and degrees of potency ranging from the favorable one in *A. eurycephalus* and those in plants, cited by Gustafsson, to 'creeper' in fowls and others that barely allow the heterozygous bearers to propagate and survive (4, 26, MS.). Comparable examples of the more or less effects of other single or double genes are proposed (Nabours and Stebbins, MSS.).

7. Many of the females of *P. texanus*, *A. eurycephalus*, *Telmatettix aztecus* and other species were partheno-reproductive. The unfertilized eggs, with rare exceptions, hatched into females. Segregation and crossing over of the genes occurred in the gametogenesis of partheno-reproduction to the same extent as when the eggs were fertilized (Nabours, 1919, 1925, 1929). Such partheno-produced individuals were, with possibly a few exceptions, homozygous for all the recognizable genes they carried.
8. Females were partheno-reproductive and then, upon mating, gave additional progeny of both sexes which exhibited the characteristics of the male parent as well. The mated females could have part of their ova fertilized and also produce from unfertilized eggs additional offspring, as in straight parthenogenesis. The females were rarely partheno-reproductive after having mated and given offspring from fertilized eggs. It appeared that when mated to adequately potent males the females did not oviposit unfertilized eggs.
9. The members of the homologous pairs of chromosomes of the partheno-developing eggs lie close together, respectively, in early divisions and not far apart, each from the other, in later cell-generations in

such gonomeric position as to suggest that the second polocyte division had not been completed (Robertson, 1930).

10. A portion of an autosome bearing the closely linked genes for the dominant OTG color complex in *A. eurycephalus* was translocated under the X-raying (approximately 6000 r) of a male and attached to another pair.<sup>4</sup> In the cytological preparations one member of the smallest pair of autosomes (Robertson's Number 1) was found to be conspicuously shorter, and one of the middle-sized pair (Number 4) correspondingly distinctly longer, than their respective normal homologs.
11. The unbalance (deficiency in the first or smallest, and accretion on the fourth autosomes) in chromatin and perhaps the rearrangements of genes, thus fortuitously induced, profoundly influenced the viability and morphology of the post-hatched zygotes. The normal numbers of eggs hatched, but the chromosomal aberrancies and respective combinations were responsible for consistent viability results which ranged proportionately and consistently from 99+ percent lethal to 98+ percent viable up to the 3-4 instars when they were recorded (24, 27, 28, 29, MS). The effects on the bodies were from slight to monstrous morphological impairment, difficulties in moulting, feeding and other teratogenic aspects (Nabours, 1937, Plate II).
12. These cytogenetic operations and observations thus revealed for the first time, in this species, the particular pair of autosomes, Number 1, the smallest, as the bearer of all 19 of the closely linked genes for the conspicuous dominant, and the one point recessive, color patterns, and the lethal. There was also the disclosure that it was to one of the middle-sized, the fourth pair, that the OTG section of the number 1 autosome had been translocated (24, 29, MS).
13. Another x-raying<sup>5</sup> in this species translocated a portion of the Number 1 autosome bearing the gene for dominant stripes along the femora of the jumping legs (the pattern designated by W). The attachment, this time, was made to the X, sex chromosome. The genetic evidence, as usual, came first and was unmistakable (e.g. mating 6673 in MS.). It was then ascertained by cytological examination that the sex chromosome had been appreciably augmented by the autosomal chromatin and the point of the connection was quite apparent (Nabours, Stebbins and Robertson, 1941). This newly accreted sex chromosome was found to be also the bearer of an extra, perhaps the autosomal, centromere, and without having lost its own. The donor, Number 1 autosome of this translocation, was lost, possibly due to the transfer of its indispensable centromere to the accreted X, sex chromosome which survived for the experimental breeding. This translocation thereby established a conspicuous, dominant, **sex-linked**

<sup>4</sup>With grants-in-aid from the Dept of Genetics, Carnegie Institution and the Henry Fund of the National Academy of Science.

<sup>5</sup>Professors J. O. Hamilton and Leo Hudiburg of the Physics Dept., Kansas State College, rendered invaluable service in the application of the x-rays.

color pattern characteristic, the only one recorded in any species of the subfamily *Tetriginae* or, so far as we have been able to ascertain, in any species of the Orthoptera (29, MS.).

14. The donor 1st, and receptor 4th, autosomes of the first (1930-33) translocation and the receptor X, sex chromosome of the second (1933-41) x-ray induced anomaly with its extra centromere were subjected to further cytogenic experimentation separately and together. The variability in the post-hatched viability due to chromosomal deficiency, augmentation, genic displacements, extra centromere and, perhaps, other aspects of anomaly ranged consistently again from almost completely lethal to nearly normal (24, 29, MS.).
15. The altered position and location of the translocated genes appeared to make no difference in the phenotypic manifestation of the diagram-like, dominant color patterns. The OTG pattern complex was the same whether the genes were attached to the fourth or remained in the original position on the first autosome. Likewise, the yellow-brown stripe (W) along the femora of the jumping legs was not altered phenotypically by the translocation of its gene complex over and into the environment of the X, sex chromosome (29, MS.).
16. There was an obvious absence of dominance and recessiveness of most of the color patterns with respect to each other. The large majority of the patterns could be regarded as dominant to the mottled gray of the so-called wild type which was the most numerous in nature. In relation to each other these dominants over the wild type exhibited striking degrees of phenotypic blending, or some of them could have been regarded as producing mosaics of kinds (9, 13, 14, 16, 18, 21, 22, MS.).
17. There are descriptions of results, and consideration of the mooted subject of the inheritance and influence of the environment as they pertain to teratogenic features such as upturned, downturned, twisted and stubby pronota, frayed and otherwise unusual wings, abnormal abdomen and other malformed structures (2, MS.).
18. The dimorphism of long and short wings and pronota, with occasional intermediates, in *A. eurycephalus*, *P. texanus* and others, appears to be conditioned partly, at least, by the elements of the seasons (3, 18, 21).
19. This genetic-environmental conditioning of the wings and pronota in *A. eurycephalus*, *Paratettix texanus* Hancock and some other species that we have tested is in striking contrast with that in the species *Tettigidea parvipennis* Harris. In the latter the similar dimorphism in the lengths of the pronota and wings constitutes a distinct Mendelian pair of characteristics with short dominant and long recessive. Neither the elements of the seasons nor any other aspects of environment appear to alter this striking and strictly genetically controlled procedure (Nabours and MacQueen, 1937 abstract; Good, 1941).



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## AN UNDESCRIBED EVERISIBLE GLAND IN THE LARVAE OF CHLAENIUS (Coleoptera Carabidae)

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The larvae of only a few families of Coleoptera are known to possess integumental glands. Most of those that are known are noneversible glands located beneath the integument and show externally only as an opening on the surface. Several species of Centharidae and Chrysomelidae (including the new separate family Donaciidae) have scattered glands over the body. In an examination of the 124 plates in Böving and Craighead's "An Illustrated Synopsis of the Principal Larval Forms of the Order of Coleoptera" (1931) glands are shown in the larvae of the Cantharidae and Chrysomelidae and in *Hyperasis signata* Oliv. of the Coccinellidae. In *Hyperasis* these authors call the gland opening the "foramen of Peyerimhoff." The only eversible organs shown by Böving and Craighead (Plate 67, fig. 1) are found on the second thoracic and eighth abdominal segments of the larva of *Ptilodactyla serricollis* Say. These they call "retractile diverticula." There is no indication that these structures are glandular.

Packard (1895, p. 115) states that "Claus has shown that the larva of *Lina populi* and other Chrysomelidae possess numerous minute eversible glands in each of the warts on the upper surface of the body, each gland containing a whitish repellent fluid smelling like the oil of bitter almonds and containing salicylic acid derived from its food plant, which issues as pearl-like drops. Cándezè thinks the fluid may contain prussic acid. The fluid is secreted by a variable number of glandular cells, each provided with an efferent duct."

A single pair of apparently undescribed eversible glands has been found by the writers in the larvae of the carabid genus *Chlaenius*. These superficially resemble the glands figured by Böving and Craighead in *Ptilodactyla* except that there is only a single unbranched gland located laterally on each epimeron of the metathorax (fig. 3, GL) with none occurring on the abdominal segments. These have been found in preserved larvae of two species, *Chlaenius prasinus* Dejean and *C. sericeus* Forster. The specimens had been preserved in 70% alcohol and the microtome sections, described later, were made from them without benefit of better fixatives. In most of the preserved specimens, the glands were found to be protruded. These larvae are reported to live under the soil near water.

**External Appearance:** The metaepimera (fig. 2 and 3, EM) of these larvae are located dorso-caudad of the coxal articulation. The epimeral sclerite is irregularly quadrate with its longitudinal axis about three times as long as the dorso-ventral axis. Near the center of the epimeron is the

\*Contribution No. 266 from the Entomological Laboratories of the University of Illinois, Urbana.

gland opening (fig. 2, OP) which is surrounded by a semi-lunar sclerite or peritreme<sup>1</sup> (figs. 2 and 3, SC) that resembles somewhat the peritreme of a spiracle. The sclerite in *C. prasinus* is somewhat larger and more irregular in outline than that of *C. sericeus*. The gland of *C. prasinus* (fig. 2) is shown in a retracted position while the protruded position of *C. sericeus* is shown in figure 3 (GL). An enlarged drawing of this protruded gland of *C. sericeus* is shown in figure 8 where it will be noted that the external surface is partially covered with small wart-like tubercles (TU). A similarly everted condition of the gland in *C. prasinus* (fig. 6, TU) also shows that only a part of the surface is covered with tubercles and these tubercles are considerably smaller than in *C. sericeus*. When protruded the base of these glands is seen to be surrounded by the ring-like sclerite (SC).

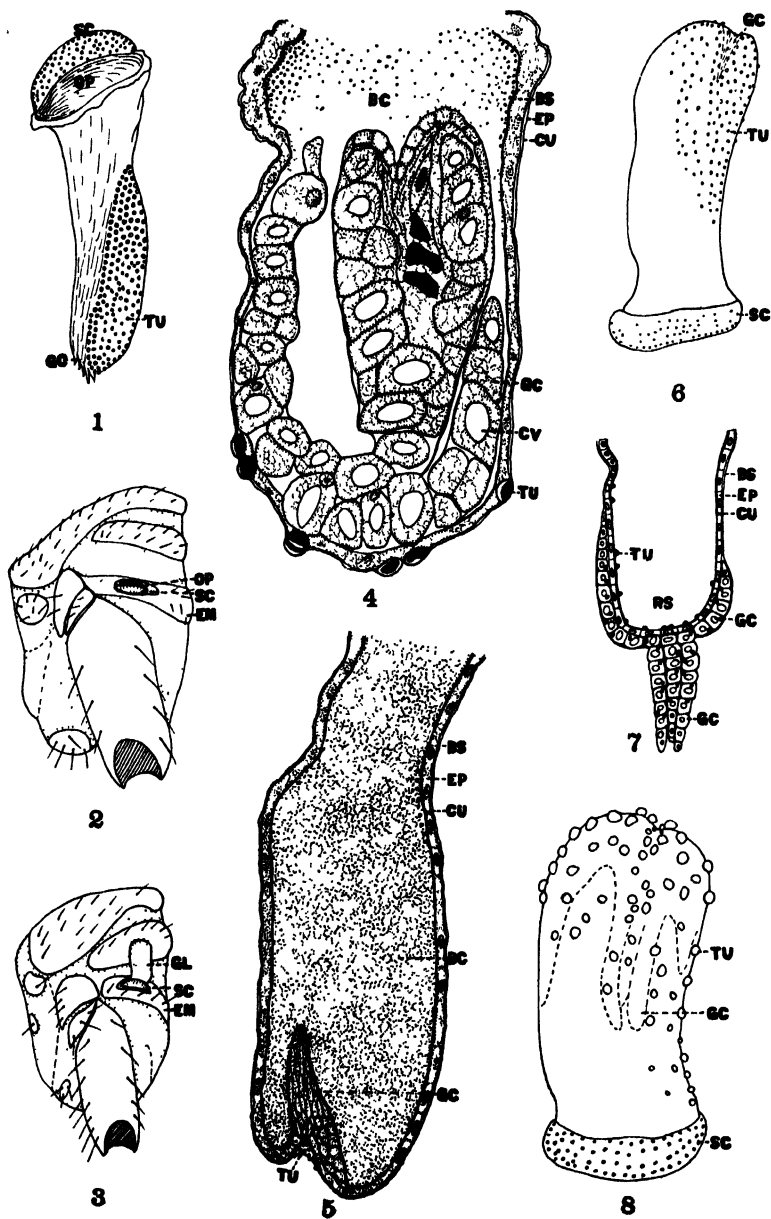
Near the distal end of the everted glands in preserved specimens, there can be seen through the cuticula, under high magnification, a cluster of cells that constitute the gland cells. These are quite different in the two species. In *C. prasinus* these cells (fig. 6, GC) are arranged in a narrow triangle, while in *C. sericeus* (fig. 8, GC) they are grouped in narrow strands which coalesce at the distal end of the gland. These secretory cells seem to have no ductuoles leading to the exterior and it seems probable that the secretions must be released by osmosis through the cuticula. These gland cells will be considered histologically below.

**The Inverted Gland:** A gland of *C. prasinus* in the normally retracted position is shown in figure 1. This drawing was made from a dissected gland and shows the outer or external appearance of the structure. The tubercles (TU) show through the body wall and are located on the inner aspect. The external sclerite (SC) and the opening of the gland (OP) are similar to the same structures shown in figure 2. On the inner or ental end of the gland there are several triangularly pointed processes (GC) which probably represent the gland cells in their normally retracted position. These show as a triangular structure in figure 6 (GC). These processes should be compared with those of a similar nature in *C. sericeus* (fig. 7, GC).

A semi-diagrammatic sagittal section of the retracted gland of *C. sericeus* is shown in figure 7. Here it will be noted that the cuticle (CU) lining the inner aspect shows the same tubercles (TU) that are noted on the outer aspect when the gland is extruded. Underneath the cuticle is a single layer of epithelial cells (EP) and the basement membrane (BS). A single layer of larger cells each with a large cavity or vacuole adjoins the basement membrane beginning at about one-half the depth of the gland reservoir (RS) and at the bottom of the reservoir become elongated into strings of cells. These (GC) cells are the finger-like processes seen through the cuticle and are represented by dotted lines in the drawing of the everted gland (fig. 8).

**Histology:** Microtome sections of the glands found in the two species

<sup>1</sup>Entomologically the term peritreme is usually thought of as a sclerite surrounding a spiracle but Torre-Bueno in his "A Glossary of Entomology" (1937) and others point out that a peritreme can be a sclerite surrounding any opening in the body. Gr. perl. around + trema hole



show them to be quite different. They were sectioned in the everted position. It is evident in both species, that they contain, when everted, a larger number of blood cells (figs. 4 and 5 BC). So that it seems safe to say that they are everted by blood pressure. No closely associated muscles were noted in either species. The structure of *C. prasinus* seems to be the more simplified. The gland cells are clustered into a triangular mass near the distal end. The cells are smaller than in *C. sericeus* and do not show the large central vacuole. Very little detail could be made out in these cells. On the other hand, in *C. sericeus* (fig. 4) the gland cells, which in figure 7 showed as string-like masses, become massed in the distal end of the gland. The cells are large and contain large cavities or vacuoles (CV) and nuclei are found crowded out toward the edge of the cells. In these cells no ductules leading to the outside of the cells were noted and there seems to be no direct means for the secretions to get to the outside of the cell except by osmosis. Apparently the secretions of the cells accumulate in the reservoir (fig. 7, RS) when the gland is retracted and are evaporated from the surface of the gland when everted. The assumption is made that these are odiferous glands (as are osmetaria in the Lepidoptera) with a repellent function.

The glands of *C. prasinus* are considerably larger when everted than in *C. sericeus* in comparable sized larvae. In *C. prasinus* the length is 0.8 mm. and the width 0.32, thus being about four times as long as broad. The length of *C. sericeus* is 0.4 mm. and its width is 0.14 mm. Thus it is noted that the length of the gland in *C. prasinus* is about twice as long as in *C. sericeus*.

The writers are indebted to Yu-Su Liu (Mrs. H. F. Chu) for her invaluable help in the preparation of microtome sections of these glands. Her knowledge of histological technique has made it possible to prepare slides for study from specimens that were poorly preserved for such a study.

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#### EXPLANATION OF FIGURES IN PLATE.

- Fig. 1. *Chlaenius prasinus*, a gland in normal retracted position  
Fig. 2. *Chlaenius prasinus*, lateral aspect of metathorax showing the opening of the gland.  
Fig. 3. *Chlaenius sericeus*, lateral aspect of metathorax showing the protruded gland  
Fig. 4. A sagittal section of a protruded gland of *Chlaenius sericeus*.  
Fig. 5. A sagittal section of a protruded gland of *Chlaenius prasinus*.  
Fig. 6. *Chlaenius prasinus*, a gland in protruded condition.  
Fig. 7. *Chlaenius sericeus*, a semi-diagrammatic drawing showing the sagittal section of the gland in normal retracted position  
Fig. 8. *Chlaenius sericeus*, a gland in a protruded condition

#### EXPLANATION OF ABBREVIATIONS

BC	Blood cell	GC	Gland
BS	Basement membrane	OP	Opening of gland
CU	Cuticle	RS	Reservoir
CV	Cavity of gland cell	SC	Sclerite of gland
EM	Epimeron	TU	Tubercle
EP	Epithelium		

## NOTES AND DESCRIPTIONS OF DORILAIIDAE (Pipunculidae-Diptera)

D. ELMO HARDY\*

Since the writer's revision of the Nearctic Dorilaidae was published, the following synonymy and homonymy has been noted:

**Pipunculus hertzogi** Rapp, 1943, Ento. News, 54: 118. This is a synonym of **Dorilas ater** (Meigen). Synonymy confirmed by Mr. E. T. Cresson who studied the type in the Philadelphia Academy of Science collection.

**Pipunculus nudus** Rapp, 1943, Ento. News, 54:223-224. Synonym of **Tömösváryella coquilletti** (Kertész). Synonymy confirmed by Mr. E. T. Cresson who studied the type. The writer studied three specimens which Mr. Rapp said were paratypes, although they were not labeled as such. A male from the type locality was **T. coquilletti** (Kert.). Two females from Montreal cannot be determined without being associated with the males; they belonged to two different species neither appearing to fit with the type. The above mentioned specimens may possibly have been considered metatypic by Rapp. Even though he called them paratypes he failed to list them in his paper.

**Pipunculus nudus** var. **tangomus** Rapp, 1943, Ento. News, 54:224. Synonym of **Tömösváryella sylvatica** (Meigen). Mr. Cresson studied the type and confirmed this synonymy. The writer studied two paratypes, which had not been labeled. One male from the type locality was a specimen of **Dorilas caudatus** var. **discolor** (Banks). The other male from La Trappe, Quebec, belonged to **Tömösváryella similis** (Hough). The writer fails to see how three very distinct species belonging to two well-defined genera can "conform structurally." Besides being a synonym, the name **P. nudus** Rapp is preoccupied by **nudus Kertész**, 1912, Ann. Mus. Nat. Hung., 10:294.

**Allomethus oleus** Rapp, 1943, Ento. News, 54:223. This appears to be a synonym of **Dorilas aequus** var. **argryofrons** (Hardy-Knowlton). Mr. Cresson reported by correspondence "Of this species we have two females, one labeled type, the other allotype. What became of the two males (one which should be the type) I do not know." He further indicated that the specimens fit in the genus **Dorilas** and run out in the writer's key with **atlanticus** (Hough) and **aequus** (Cresson). The antennae are broken from the specimens and Mr. Cresson was not able to place the species further.

**Dorilas dudai** n. n.

New name for **Dorylas<sup>1</sup> curvibibia** Duda, 1940, Folia Zoologica et Hydrobiol., 10:218. Preoccupied by **Dorilas femoratus curvibibiae** Hardy, 1939, Journ. Kans. Ento. Soc., 12:19-20.

**Dorilas electus** n.n.

New name for **Dorylas caudatus** Duda, 1940, Folia Zoologica et Hydrobiol., 10:217. Nec. **D. caudatus** (Cresson), 1911, Trans. Amer. Ento. Soc., 36-289.

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<sup>1</sup>Kertész' amended spelling of **Dorilas**.

***Dorilas peruensis* n.n.**

New name for *D. umbrinus* (Becker) 1900, Berl. Ento. Zeits., 45:245. Nec *D. umbrinus* (Loew), 1857, Ofvers. K. Vet. Akad. Forh., 14:374.

Becker described what he thought was the female of *umbrinus* from Peru. The writer has studied the female of Loew's species from Africa and found it to be very distinct from that which Becker described from South America. Becker's specimen in the Berlin Zoological Museum will be set up as the type of *D. peruensis*.

***Dorylomorpha rufipes aczeli* n.n.**

New name for *Tömösváryella* (*Dorylomorpha*) *rufipes minima* Aczel, 1939, Zool. Anz., 125:65. Preoccupied by *Tömösváryella minima* (Becker), 1897, Berl. Ento. Zeits., 42:85.

***Tömösváryella aliena* n.n.**

New name for *T. propinqua* Hardy, 1943, Kans. Univ. Sci. Bull., 29:169-171. Preoccupied by *T. propinqua* (Becker), 1913, Ann. du Mus. Zool. de L'Acad. Imp. Sci. St. Petersb., 17:607.

Becker's *Dorylas propinquus* is obviously a *Tömösváryella*. He states that it belongs "aus der gruppe mit fehlendem Randmal" and is related to *littoralis* Becker.

***Dorilas* (*Dorilas*) *apicarinus* (Hardy-Knowlton)**

New Combination

(Figs. 1a-b)

***Pipunculus femoratus***<sup>2</sup> var. *apicarinus* Hardy-Knowlton, 1939, Ann. Ento. Soc. Amer., 32:114-115.

The discovery of a female specimen which apparently belongs to *D. apicarinus* (Hdy-Kn) indicates that this is a distinct species and should be separated from *houghii* (Kertész).

The species is distinguished from *D. houghii* by its dark brown to black third antennal segment, the longer third costal section of the wing, the more sinuate ultimate section of the fourth vein, and the marked difference in the genitalia of both sexes. The male has a rather small apical membranous area which does not extend down the dorsum as in *houghii* and the apical keel is well developed (cf. figs. 43D and 44B, Hardy, 1943, Univ. Kan. Sci. Bull., 29:209). The female genitalia are characterized by the presence of a pair of tubercles on the underside of the ovipositor. Following is the first description of a female of this species:

**Female. Head:** Front, face and occiput silvery gray pubescent, only the ocellar triangle shining black. Antennae dark brown, third segment very finely pubescent and short acuminate in shape (fig. 1a). **Thorax:** Mesonotum brownish gray pollinose, pleurae gray. Anterior portion and lateral margins of metanotum rather conspicuously covered with pale pile, very fine yellow dorsocentral hairs present. Scutellum with a few short yellow

<sup>2</sup>*P. femoratus* Cresson is a synonym of *P. houghii* Kertész.



hairs on the hind margin. Propleurae each with a well developed fan of long yellow hairs. Humeri and halteres yellow, tegulae brown. **Legs:** Yellow, except for the brownish coxae. The femora are very faintly discolored medianly. **Wings:** As in the male. **Abdomen:** Very slightly clavate from dorsal view, widest at about segments four to five. The first two terga are densely gray pollinose and the first has no strong lateral hairs. Terga three to five are polished black on the dorsum, gray on the sides and on hind margin except for a narrow median portion. Sixth tergum polished black except for gray sides, hind margin of sixth not excised. Abdomen rather conspicuously covered with short yellow pile. Base of ovipositor polished reddish brown, subelongate in shape and with a pair of well developed tubercles below. Piercer yellow and straight, reaching just slightly beyond the apex of the second abdominal segment (fig. 1b).

**Length:** Body, 3.6 mm; wings, 5.0 mm.

The above described female was from Salt Lake City, Utah, September 3, 1941 (F. C. Harmston).

#### ***Dorilas (Eudorylas) bilobus* n. sp.**

(Figs. 2a-d)

The species is related to *D. aequus* (Cresson) and is distinguished by the unusual development of the male hypopygium. It runs out with *aequus* in couplet 37 of the writer's key to the genus *Dorilas*<sup>1</sup>. It separates by having the eighth abdominal segment entirely reddish to yellow, two times as long as the fifth abdominal segment and over one-half as long as the remainder of the abdomen from lateral view; also in being pointed at the apex as seen from dorsal and lateral views (figs. 2a, 2d). The eighth segment of *aequus* is black, is slightly shorter than the fifth segment and rather quadrate in outline. From a lateral view the eighth segment is scarcely one-fifth as long as the remainder of the abdomen. The harpagones are also very different in both species.

**Male. Head:** Face and front densely silvery pubescent, occiput entirely cinereous. Junction of the eyes equal to the length of the frontal triangle. First two antennal segments yellow brown, second segment with very short inconspicuous bristles above and below. Third segment yellow, long acuminate at apex (fig. 2c). Bases of aristae yellow. **Thorax:** Opaque grayish-brown pollinose on the dorsum, gray on the sides. Mesonotum and scutellum almost devoid of pile. Propleurae bare. Humeri, tegulae and halteres yellow. **Legs:** Almost entirely yellow, coxae and last tarsal subsegments brownish yellow, hind femora very faintly brownish in the middle. All femora moderately slender, flexor spines weak. Hind tibiae somewhat swollen medianly and slightly arcuate, with no strong bristles on the outside median surface. **Wings:** Hyaline, stigma light brown and filling all of the third costal section. The third section is just slightly longer than the fourth and the two sections combined are one and one-half times longer than the fifth. The r-m crossvein is at the basal one-third of the discal cell and the ultimate section

<sup>1</sup>1943, Univ. Kans. Sci. Bull., 29:58.

of the fourth vein ( $M_{1+2}$ ) is very slightly curved. **Abdomen:** Entirely opaque, almost devoid of pile. The first tergum is gray and has three short black bristles on each side. The other terga are brown pollinose on the dorsum, gray on the sides and posterior margins, except for a narrow median interruption. The venter is entirely yellow. The abdomen is very slightly clavate in shape, being widest at segments four to five. The fifth is rather strongly developed on the right side. The sixth and seventh terga are well developed, and visible from a dorsal view. These sclerites are lateral in position and do not extend around the venter beneath the genitalia. **Hypopygium:** Very strongly developed. Two times longer than the fifth abdominal segment from dorsal view (Fig. 2d). The entire genitalia are equal in length to the remainder of the abdomen from segments one to five and the eighth segment alone is over half the combined length of the remaining segments from a lateral view. The hypopygium has an elongate membranous area just to the left of the apex and this possesses a small unsclerotized development in the middle (Fig. 2a). From dorsal view, a basal cleft is visible on the right side and the segment is pointed apically (Fig. 2d). The harpagones fold down and lie beneath the fifth sternum in their normal position and are not visible unless pulled out. Both harpagones are bilobed and have a long slender lateral lobe at bases which curve down into the genital cavity. The outer harpago is developed into an elongate slender projection at apex. The inner is obtuse, rounded at the apex (fig. 2b). Harpagones conspicuously yellow pilose.

**Length:** Body, 4.5 mm; wings, 5.3 mm. Female unknown.

Holotype male: Cold Spring Harbor, Long Island, New York, May 30, 1931 (C. H. Curran). Type returned to the American Museum.

### **Dorilas (Eudorylas) dives n. sp.**

(Figs. 3a-c)

This species appears most closely related to *D. varius* (Cresson) but actually belongs in a different subfamily because of the bare propleurae. It runs out with *varius* in couplet 17 of the writer's key to the genus.<sup>4</sup> It is distinguished by the lack of bristles on the propleurae; the elongate third costal section of the wing; the very short petiole of the cubital cell; having the r-m crossvein situated near the basal third of the discal cell and the first abdominal tergum without strong hairs or bristles on the sides. The genitalia are also distinctive.

**Male. Head:** Eyes joined for distance equal to slightly greater than the length of the front, this junction extends to within two or three facets of the median ocellus. The front is brown to black in ground color, rather lightly covered with gray pubescence. The median portion of the front is raised into a longitudinal ridge, this is polished black at about the lower one-third of the front. Face shining black in ground color and gray pubescent. Occiput gray below and slightly subshining brownish pollinose above.

<sup>4</sup>1943, Univ. Kans. Sci. Bull., 29:57

Antennae brown, third segment acute at apex (fig. 3a). **Thorax:** Subshining black in ground color, gray on pleurae and metanotum, lightly brownish pollinose on the mesonotum and scutellum. A few very short, inconspicuous dorsocentral and scutellar hairs are present. Humeri and tegulae black, halteres yellow brown. **Legs:** Chiefly black, apices of femora, most of tibiae and tarsi yellow. All tibiae discolored with brown to black medianly. Femora slender, flexor spines very weak. **Wings:** Faintly fumose, stigma yellow brown and filling all of the third costal section. Third section three times longer than the fourth. The two combined are about equal in length to the fifth section. The r-m crossvein is at the basal one-third of the discal cell and the ultimate section of the fourth vein is just slightly curved. The petiole of the cubital cell is less than one-half as long as the m-cu crossvein. **Abdomen:** Polished black except for opaque grayish brown first tergum, opaque brown anterior three-fourths of the second tergum and for an opaque brown median spot on anterior edge of third tergum. Sides parallel or nearly so. Pile rather conspicuous but very sparse. First tergum with no well-developed comb of hairs or bristles on the sides. Sixth and seventh terga not visible from a dorsal view, these plates are ventral in position and poorly developed. **Hypopygium:** Large and well-developed, about equal to the fifth segment in length and strongly compressed to the right (Fig. 3c). A large subapical membranous area is on the venter of the eighth segment on the left side, this membranous area is not visible from a dorsal view and possesses a small raised portion in the middle above. The hypopygium is conspicuously haired. The harpagones are very short, broad and rounded at their apices, they are scarcely two times as long as wide (Fig. 3b).

**Length:** Body, 3.0 mm.; wings, 3.5 mm.

Female unknown.

Holotype male: Vic. Indianapolis, Indiana, July 16, 1944 (F.C. Harmston). One paratype male same locality and collector July 9, 1944.

Type returned to the Utah State Agricultural College, paratype retained in the Iowa State College Collection.

#### ***Dorilas (Eudorylas) tarsalis* (Banks)**

(Fig. 4a)

***Pipunculus tarsalis* Banks, 1911, Trans. Amer. Ento. Soc., 36:309-310.**

This is the first description of the female of this species. It is related to *montivagus* Hardy and runs out with that species in couplet 89 of the writer's key to the *Dorilas*. It is distinguished by the longer stigma which fills over half of the third costal section; the fifth costal section not longer than the third and fourth combined; the ultimate section of the fourth vein gently curved; more of front polished black and the piercer of ovipositor very slender, abruptly terminating its small subglobose base (Fig. 4a).

The female differs from the male as follows: The front is as wide as the face and is very slightly expanded just above the median portion. Upper three-fourths of the front polished black. Lower portion gray pubescent, the

polished portion extends into the gray as a narrow median line ending the length of three eye facets above the antennae. The sixth abdominal tergum is subshining, very lightly pollinose, its posterior margin is not excised. The ovipositor base is black in ground color and finely gray pubescent. The base is nearly as wide as long and has a small swelling on the posterior portion below. The piercer is slender, straight and reddish yellow in color, it is separated from its base by a distinct suture. The piercer is slightly longer than its base (fig. 4a) and extends to about the apex of the third abdominal segment.

**Length:** Body 3.0 mm.; wings, 3.4 mm.

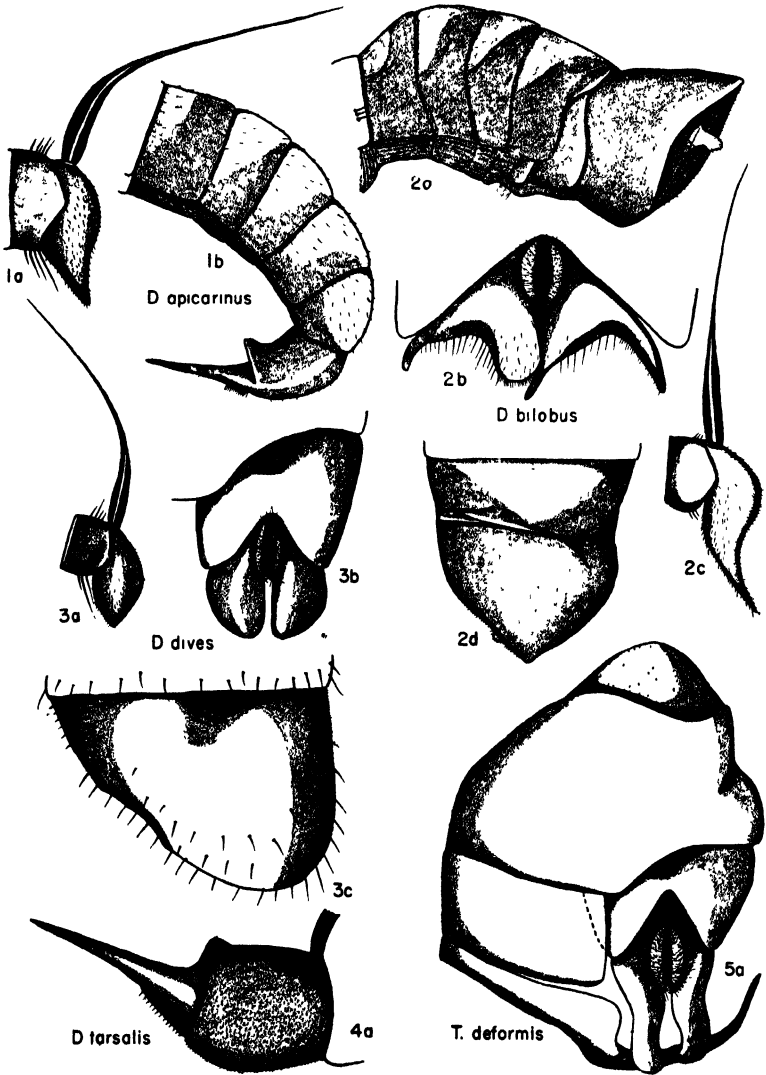
The above described female was from Missaukee Co., Michigan, July 8, 1945 (R. R. Dreisbach).

***Tömösváryella deformis* n. sp.**

(Fig. 5a)

This species is related to *T. contorta* Hardy and runs out with that species in couplet 1 of the writer's key to the genus. It is distinguished by having the male hypopygium almost bare, not densely pilose as in *contorta*. The dorsal cleft of the hypopygium is more to the left side instead of being in the middle. The ninth sclerite is cleft nearly to its base, and cleft on its hind margin extends about four-fifths its length on a middle line instead of about half its length as in *contorta*. The harpagones are thicker and shorter, more rounded at their apices and about equal in length to the seventh abdominal sclerite (fig. 5a). The harpagones of *contorta* are slender, elongate, pointed at inner apices and one-third longer than the seventh sclerite. *T. deformis* is also more subshining not so gray pollinose as is *contorta*.

**Male. Head:** Junction of the eyes about equal to the length of eight eye facets. Upper portion of front and ocellar triangle shining black, frontal triangle and face silvery pubescent. Front with a longitudinal indented area extending to just above antennae. Third antennal segment moderately acuminate, brown in ground color, and densely white pubescent. Occiput subshining to polished black on upper third, cinereous below. **Thorax:** Subshining black in ground color, brownish pollinose on the dorsum, gray on the sides. A few very small, inconspicuous dorsocentral and scutellar hairs are present. Humeri and halteres yellow, tegulae black. **Legs:** Chiefly black, tarsi, narrow apices of femora and tibiae and bases of tibiae yellow. Hind trochanters each with a well-developed tubercle beneath. Hind femora and tibiae strongly bent and swollen on apical halves. Hind tarsi markedly flattened and broad. **Wings:** The third section of the costa is one-half as long as the fourth and the fifth section is one and one-half times longer than the third and fourth combined. The r-m crossvein is at the middle of the discal cell and the last section of the fourth vein is straight. **Abdomen:** Rather sparsely haired, chiefly subshining brownish black, lightly grayish on the first tergum and on the sides. First tergum with a comb of long hairs on each side. **Hypopygium:** In addition to the above given genital characters the eighth segment terminates in a large apical membranous area (Fig. 5a). The



sixth segment is greatly attenuated on the venter and extends beneath the harpagones.

**Length:** Body, 3.0 mm.; wings, 3.3 mm.

**Female:** A specimen at hand apparently belongs with the male, although the hind legs are not so noticeably curved as in the female of *contorta*. The front is broad, distinctly wider than the face and shining black on the upper one-third. Hind trochanters white pubescent beneath, without tubercles. Hind femora and tarsi not greatly enlarged and curved as in the male and hind tarsi not so strongly flattened and broad. The abdomen is sparsely pilose and the sixth tergum is not excised on its hind margin. The base of the ovipositor is globose and small, black in color. The piercer is slender, straight and yellow. It is about one and one-half times longer than its base and extends just beyond the apex of the third abdominal segment.

**Length:** Body and wings, 3.0 mm.

Holotype male: Crestview, Florida, Oct. 15-16, 1914. Allotype female, data as for type. Both returned to the American Museum of Natural History.

#### EXPLANATION OF PLATE

Fig 1 *Dorilas apicarinus* (Hardy-Knowlton).

(a) Antenna of female

(b) Female abdomen, lateral view

Fig 2 *D. bilobus* n. sp.

(a) Male abdomen, left side

(b) Male harpagones

(c) Antenna.

(d) Male hypopygium, dorsal.

Fig. 3 *D. dives* n. sp.

(a) Antenna.

(b) Male hypopygium, ventral

(c) Male hypopygium, dorsal.

Fig 4 *D. tarsalis* (Banks).

(a) Female ovipositor, lateral.

Fig 5. *Tomosvaryella deformis* n. sp.

(a) Male hypopygium, ventral

## A NEW SPECIES OF CYMATIA FROM AUSTRALIA (Hemiptera, Corixidae)

H. B. HUNGERFORD\*

While checking corixid material in the Snow Collections in an attempt to make a generic key to the Corixidae of the world, we discovered a new species of the genus *Cymatia* Flor in some material taken by R. G. Wind on the Prince of Wales Island, Australia. This is the first record of any of the *Cymatia* group from Australia. The key following the description will separate this new species from the rest of the genus.

### *Cymatia nigra* n. sp.

**Size:** Length, ♀ 4.6 mm. Width of head across eyes 1.6 mm.

**Color:** This little species is quite striking in appearance. The frons and vertex of the head are orange-yellow, while the rear margin behind the eyes is black. Pronotum and hemelytra are solid mahogany brown, approaching black, except for an orange-yellow half moon-shaped spot at the outer distal angle of the corium. The left membrane is straw colored while the right is dark. The embolium and venter smoky to black; the legs dark brown. As viewed from above, the species very closely resembles *Heterocorixa nigra* Hungerford.

**Structural characteristics:** Head three-fourths as long as the pronotal disk. Postocular space at least four times as broad as the diameter of an eye face. Interocular space narrower than the width of an eye. Vertex not produced. Face covered with long hairs. Beak reduced, without sulcations. Antennal segments: 1 : 2 : 3 : 4 : : 8 : 12 : 30 : 18 ♀.

Breadth to length of the pronotal disk as 100 : 45. No median longitudinal carina on disk. The claval pruinose area about half as long as the post-nodal pruinose area, and the distance between the shining basal angles of the clavus and corium compared to the total length of the claval pruinose area from the claval angle as 1:2:½. (In other *Cymatia* spp. this ratio at least as great as 1 : 4. See plate.)

Lateral lobe of prothorax elongate, apex broadly rounded. Mesoepimeron narrow with osteole near its tip; base of mesoepimeron inflated, almost concealing the lateral prothoracic lobe. Metaxyphus small, broader than long.

Front leg of female: pala with six long lower palmar hairs (or sieve hairs), seven short upper palmar hairs, and seven long dorsal hairs; palar claw long and slender. Tibia with one or two short apical hairs. Femur pilose on basal third; distal two thirds armed with two long ventral spines and two short ones. (See plate.) Proportions of segments of front, middle, and hind legs as follows:

Front leg: femur : tibia : pala : claw : : 100 : 32 : 100 : 64.

Middle leg : femur : tibia : tarsus : claws : : 100 : 52.4 : 36.9 : 22.3.

Hind leg: femur : tibia : tarsus 1 : tarsus 2 : : 100 : 87.5 : 105.3 : 52.3.

Basal portion of hind femur pubescent ventrally for more than half its length;

---

\*Contribution from the Department of Entomology, University of Kansas, Lawrence, Kansas.

distal glabrous portion with eight to ten scattered stout pegs ventrally and two or three dorsally.

Female abdomen with penultimate ventral lobe broadly rounded medially, and with the anal lobes notched on their inner margin (see plate).

**Comparative notes:** The color pattern and the shape and comparative measurements of the claval pruinose area will separate this little species from other *Cymatia*. Structurally, the female is closest to *Cymatia apparens* (Distant) from which it may be distinguished by the above characters.

**Location of types:** Described from ♀ holotype labeled: "Australia, Prince of Wales Island, Febr. 15, 1939, R. G. Wind." This specimen purchased from R. G. Wind and now in the Francis Huntington Snow Collections, University of Kansas.

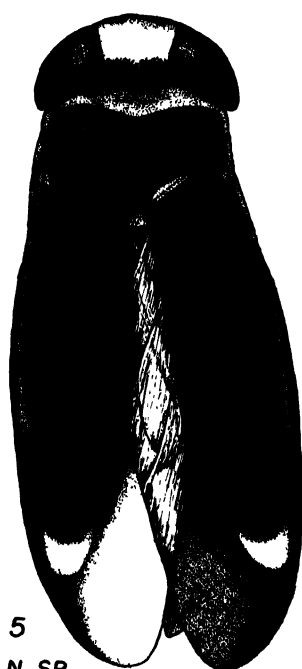
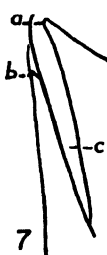
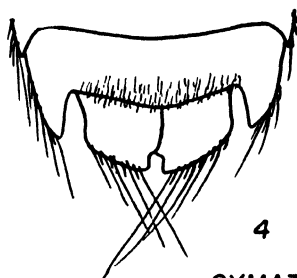
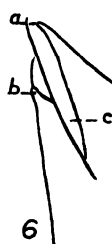
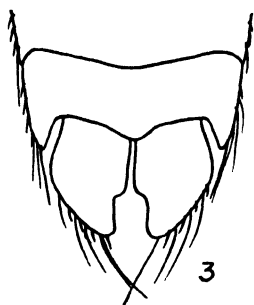
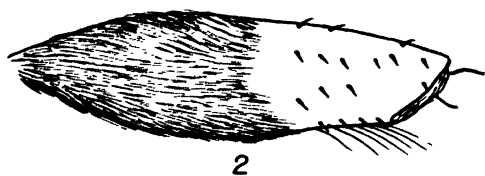
### Key to *Cymatia* Flor

1. Claval pruinose area short, the distance between the shining basal angles of the clavus and corium compared to the length of the pruinose area from the claval angle as 1 : 2½. Color solid black (or very dark brown) with pale spot at outer angle of corium, and left membrane pale ..... *C. nigra* n. sp.  
Claval pruinose area long, the distance between the shining angles of clavus and corium compared to the length of the pruinose area from the claval angle at least as great as 1 : 4. Color pattern, if solid, then pale ..... 2
2. Small species, less than 4.5 mm. long. Pronotal disk four times as broad as long ..... *C. coleoptrata* (F.)  
Species more than 4.5 mm. long. Pronotal disk about twice as broad as long ..... 3
3. Pronotum and hemelytra covered with fine reticulation of brown lines; with short stout pegs all over the ventral shining portion of hind femur; male without a right clasper ..... *C. rogenhoferi* (Fieb.)  
Pronotum usually without brown markings or with only faint cross bands. Hemelytral pattern with more or less definite brown bars on clavus and brown spots on corium. With only a few stout pegs on ventral shining portion of hind femur. Males possessing a right clasper ..... 4
4. Anterior margin of head not produced. Corial pattern in moderately distinct longitudinal series ..... *C. apparens* (Dist.)  
Anterior margin of head produced. Corial pattern not as above ..... 5
5. Interocular space narrower than or about equal to the width of an eye. Rear margin of last ventral abdominal segment of female normal. Right clasper of male a broad plate ..... *C. bonsdorffi* (C. Sahlb.)  
Interocular space considerably broader than the width of an eye. Rear margin of last ventral abdominal segment of female quadrately produced. Right clasper of male narrow in distal half *C. americana* Hussey



## EXPLANATION OF PLATE

- Fig. 1. *Cymatla nigra* n. sp.; front leg of female.  
Fig. 2. *Cymatla nigra* n. sp.; venter of hind femur.  
Fig. 3. *Cymatla apparens* (Dist.); last three ventral abdominal segments of female.  
Fig. 4. *Cymatla nigra* n. sp.; last three ventral abdominal segments of female.  
Fig. 5. *Cymatla nigra* n. sp.; dorsal aspect.  
Fig. 6. *Cymatla nigra* n. sp.; lateral view of base of left hemelytron.  
    (a) Pigmented, shining basal angle of clavus  
    (b) Pigmented, shining basal angle of corium.  
    (c) Claval pruinose area.  
Fig. 7. *Cymatla apparens* (Dist.); lateral view of base of left hemelytron.  
    (a) Pigmented, shining basal angle of clavus.  
    (b) Pigmented, shining basal angle of corium.  
    (c) Claval pruinose area.



*CYMATIA NIGRA* N. SP.

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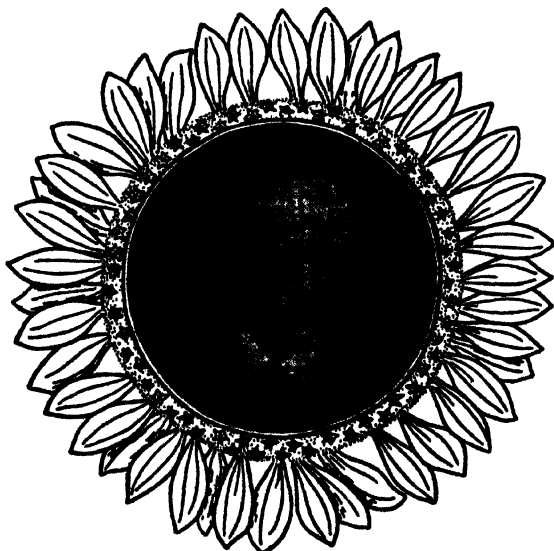
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## SOME NEW SPECIES OF DELPHACODES (Continued)

(Homoptera, Fulgoridae, Delphacinae)

## Part III

R. H. BEAMER\*

Lawrence, Kansas

21. *Delphacodes trimaculata* n. sp.**Brachypterous Form:**

Resembling *Delphacodes waldeni* (Metc.) but smaller, color shiny golden brown with a black spot on base of scutellum, above middle coxae and on face. Length ♂ 2.0 mm.; ♀, 2.4 mm.

**Structure:** Front about one third longer than wide, widest near middle, slightly narrowed toward apex, more so toward base, tricarinate, middle carina blunt; crown almost without carinae, longer than wide, wider at apex than base, apex broadly rounded; elytra almost as wide as long, apices truncate, veins slightly heavier, not very definite, extending to third abdominal segment; hind wings small pads, scarcely one third as large as an eye.

**Color:** General color shining fulvous; abdomen darker than thorax, often with a still darker broad, longitudinal stripe on either margin, a large spot above middle coxae, another in base of scutellum and genae black, this latter in females often involves whole front; venter of female more or less dark, male genital capsule black.

**Genitalia:** In lateral view pygofer very narrow; anal segment without processes but antero-ventral corners enlarged to form aedeagal guide; aedeagus about twice as long as greatest width which is at end of basal third due to angular bulge, apex rounded; styles widest at base, greatly narrowed near basal third, enlarged on outer third and narrowed to slender apices; in caudal view styles widest at base, narrowed to outer third, widened to triangular apices; practically no aedeagal brace.

Holotype ♂, allotype ♀, 39 ♂ and 38 ♀ paratypes, Storrs, Conn., Aug. 14, 1946, R. H. Beamer; other paratypes: same place and collector, 13 ♂ ♂ and 10 ♀ ♀, Aug. 3, 1946; same place and collector, 4 ♂ ♂ and 1 ♀, Aug. 4, 1946; same place and collector, 1 ♂, Aug. 10, 1946; 2 ♂ ♂ and 1 ♀, Willimantic, Conn., Aug. 5, 1946, R. H. Beamer; 1 ♀, 3 ♂ ♂, Ashton, Md., Aug. 27, 1938, P. W. Oman; 6 ♀ ♀, Washington, D. C., Sept. 22, 1934, P. W. Oman; 1 ♂, Arlington, Va., July 30, 1938, P. W. Oman. Paratypes in the U. S. National Museum.

**Macropterous Form:**

Like the brachypterous form except wings extending one third their length beyond abdomen whitish-semihyaline with darker veins; color

\*Contribution from the Department of Entomology, University of Kansas.

black except legs, clypellus, dorsum of thorax and pronotum back of each eye to base of wings stramineous.

Holomorphotype ♂, allomorphotype ♀, 3 ♂ and 16 ♀ paramorphotypes, Storrs, Conn., Aug. 14, 1946, R. H. Beamer; other paramorphotypes; same place and collector, 4 ♂ ♂ and 3 ♀ ♀, Aug. 3, 1946; same place and collector, 1 ♂, Aug. 4, 1946; same place and collector, 1 ♀, Aug. 10, 1946; 1 pair, Willimantic, Conn., Aug. 5, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

## 22. *Delphacodes penepuella* n. sp.

### Brachypterous Form:

Resembling *Delphacodes puella* (V. D.) but dark spot at apex of clavus continued diagonally forward across elytra, crown narrower and longer and aedeagus bent ventrally instead of dorsally with only five teeth near middle. Length ♂ 1.5 mm.; ♀, 1.8 mm.

**Structure:** Front about twice as long as wide, definitely constricted at base, very slightly so at apex, in between almost parallel-sided, strongly tricarinate; crown more than one third longer than basal width, widest at apex, strongly carinate; elytra widest near middle, apices broadly rounded, reaching almost to genital capsule in ♂ to fourth abdominal segment in ♀; hind wings reduced to less than one fourth size of eye.

**Color:** General color dark with legs, carinae of front, anterior half of crown, hind border of pronotum, apex of scutellum, base of abdomen, some spots on lateral margin of abdomen, the posterior margin of some abdominal segments and elytra, except the rather broad diagonal cross band from tip of clavus forward, stramineous to cinereous.

**Genitalia:** In lateral view pygofer about one third deeper than long; anal segment with a pair of processes arising near middle, often distorted as to shape and origin; aedeagus widest at base, gradually tapered to dorsally turned tip, bent ventrally at less than a right angle near basal third; styles widest at base, more or less pediform on outer two thirds; in caudal view widest at base, very slightly narrowed and curved laterally, then medianly with apex right-angled on inner margin and slightly rounded and bulged on outer margin.

Holotype ♂, allotype ♀, 34 ♂ and 56 ♀ paratypes, Otter Lake, N. Y., July 25, 1946, R. H. Beamer; 2 ♂ ♂, Hilliard, Fla., Oct. 5, 1938, P. W. Oman; ♂ South of Picnic, Fla., Nov. 8, 1938, P. W. Oman. Paratypes in the U. S. National Museum.

### Macropterous Form:

Like brachypterous except elytra and flight wings extending about one third their length beyond abdomen and dark spot at tip of clavus not extending diagonally forward across elytra.

Holomorphotype ♂, Hilliard, Fla., Aug. 31, 1930, R. H. Beamer.

Types in Snow Entomological Collections.

**23. *Delphacodes recurvata* n. sp.****Brachypterous Form:**

Resembling *Delphacodes waldeni* (Metc.) but smaller, generally lighter in color and male with a pair of recurved processes on anal segment. Length ♂ 2.3 mm.; ♀ 2.6 mm.

**Structure:** Front about twice as long as wide, widest at middle, narrowed toward each end, more so toward base, about half as wide at base as middle, strongly tricarinate; crown about twice as long as wide, carinae definite; elytra barely longer than wide, apices truncate, extending on to second abdominal segment, hyaline, veins heavier; hind wings not evident.

**Color:** Stramineous to brownish with a small darker spot in apices of elytra, semblance of darker longitudinal lines on dorsum of abdomen, aedeagus and styles brown

**Genitalia:** In lateral view anal segment with a pair of long slender processes arising on antero-ventral corner of anal segment and recurved to extend parallel with ventral margin; aedeagus widest at base, contracted near basal third to half basal width, slightly curved ventrally with three fairly large teeth on dorsal margin near outer third, aedeagal brace evident; styles swollen near middle on inner margin with flange on outer margin at apical third. In caudal view styles arcuate, widest at middle with curving flange on apical third of inner margin.

Holotype ♂, allotype ♀, Hilliard, Fla., July 28, 1934, R. H. Beamer; paratypes 1 ♂ same place and date, M. E. Griffith; 1 ♂, Punta Gorda, Fla., Mar. 12, 1947, R. H. Beamer; 18 ♂♂ and 7 ♀♀, Sanford, Fla., Mar. 11, 1947, R. H. Beamer; 1 ♂, Sanford, Fla., May 7, 1926, E. D. Ball; 1 ♂, Sanford, Fla., June 4, 1926, E. D. Ball; 1 ♂, Sanford, Fla., Oct. 29, 1926, E. D. Ball; 1 ♀, Sanford, Fla., Dec. 11, 1926, E. D. Ball; 1 ♀, Sanford, Fla., May 13, 1926, E. D. Ball; 1 ♀, Coco Fla., May 5, 1926, E. D. Ball; 3 ♀♀, Gainesville, Fla., Nov. 5, 1927, 1 ♂ and 2 ♀♀, Washington, D. C., Oct. 26, 1941, P. W. Oman. Paratypes in the U. S. National Museum.

**Macropterous Form:**

Like the brachypterous form but with both pairs of wings about one third longer than abdomen; elytra milky semihyaline with veins brown, especially so on outer half.

Holomorphotype ♂, Coconut Grove, Fla., Paul W. Oman.

Types in Snow Entomological Collections.

**24. *Delphacodes incurva* n. sp.****Brachypterous Form:**

Resembling *Delphacodes nigriscutellata* Bmr. but much smaller, elytra with apices rounded, base of crown usually light in color and processes of anal segment with apices sharply bent in. Length of ♂ 1.8 mm.; ♀ 2.0 mm.

**Structure:** Front not quite twice as long as wide, widest near middle, narrowed toward each end, very slightly more so toward base, almost without carinae, median carina more or less distinct in female; crown barely

longer than wide, narrowest near middle, apex broadly rounded, carinae becoming more distinct on basal half; elytra extending on to third abdominal segment, slightly longer than broad with apices broadly rounded, veins heavier; in female apices slightly less rounded.

**Color:** General color stramineous. Male with cloudy spot above hind coxae, large spot above middle coxae, face below eye and in front of antennae, front, anterior half of crown, scutellum, dorsum of abdomen, except large basal area, most of last segment and dorsum of genital capsule, dark brown to black; female entirely light colored.

**Genitalia:** In lateral view anal segment with a pair of broad processes with sharp apices turned in at right angles; aedeagus widest at base, slightly more than twice as long as basal width, gradually narrowed and slightly S-shaped with three large teeth on ventral margin just beyond middle and three to four lateral teeth near apex, styles short, narrowed at middle, enlarged at apices and slightly bifid. Styles in caudal view distinctly avicephaliform with small, sharp beak on inner margin and large rounded head on outer.

Holotype ♂, allotype ♀, 21 ♂ and 12 ♀ paratypes, Storrs, Conn., Aug. 15, 1946, R. H. Beamer; 1 ♂ paratype, Liberal, Kansas, Aug. 16, 1945, R. H. Beamer. Types in Snow Entomological Collections.

#### 25. *Delphacodes latidens* n. sp.

##### **Brachypterous Form:**

Resembles *Delphacodes incurva* Bmr. but much larger, elytra much longer, in male extending to tip of abdomen, processes of anal segment of male with apices not bent in at right angle and styles in lateral view quite slender on outer third. Length ♂ 2.0 mm.; ♀ 2.5 mm.

**Structure:** Front slightly less than twice as long as wide, widest near middle, tapered toward each end, more so toward base, definitely tricarinate on outer half; crown longer than wide, apex broadly rounded, wider than base, carinae evident at base; elytra in male reaching to tip of abdomen, in female to third from last abdominal segment, apices broadly rounded, veins raised.

**Color.** General color stramineous, in male spot above middle coxae, genae beneath eye and in front of antennae, front except narrow apical band and scutellum, shiny black, spot above hind coxae fumose, dorsum of abdomen orange with more or less darker markings; in female a spot above middle coxae, one beneath ocellus and a row of spots on dorso-lateral margins of abdomen black, a small fumose spot above hind coxae, front light brown instead of black as in male; elytra semihyaline.

**Genitalia:** In lateral view anal segment with a pair of heavy, broad processes; aedeagus widest at base, more or less sinuate and narrowed to blunt apex, a few short teeth on each margin before tip; aedeagal brace of medium size; styles parallel-margined on basal two thirds, rapidly narrowed on outer margin on outer third. In caudal view styles widest at base, narrowing to avicephaliform apices with sharp beak on inner margin.

**Holotype** ♂, allotype ♀, 2 ♂ and 6 ♀ paratypes, Sarita, Texas, Dec. 25, 1945. Other paratypes: 1 pair, Mission, Texas, Dec. 25, 1945, R. H. Beamer; 1 ♂, San Antonio, Texas, June 25, 1938, R. H. Beamer; 1 ♂, Sheffield, Texas, July 10, 1938, R. H. Beamer; 1 ♂, Val Verde Co., Texas, June 28, 1940, D. J. and J. N. Knull, in Ohio State Collection.

Types and paratypes in Snow Entomological Collections.

## 26. *Delphacodes lutulentoides* n. sp.

### **Brachypterous Form:**

Resembling *Delphacodes lutulenta* (Van D.) but usually lighter in color, carinae of front and crown definitely stronger, styles much more spatulate in both lateral and caudal view and aedeagus with several teeth on sides. Length ♂ 2.0 mm.; ♀ 2.8 mm.

**Structure:** Front almost two thirds as wide as long, widest near middle, converging toward each end, slightly narrower at apex, strongly tricarinate; crown longer than wide, strongly carinate at least at base; elytra short, barely longer than wide, apices broadly rounded, reaching to about middle of abdomen; hind wings reduced to pads about one third size of eye.

**Color:** General color stramineous, in male more or less black between carinae of front and abdomen orange to black.

**Genitalia:** In lateral view pygofer quite narrow, hind margin excavated; anal segment without processes; aedeagus widest at base, about half as wide as total length, suddenly narrowed on ventral margin just before middle to less than half basal width, gently curved ventrally throughout; aedeagal brace large; styles, widest at base, narrowed in middle to about half basal width, apices spatulate. In caudal view styles widest at base, narrowed at middle on inner margin, apices slightly aviccephaliform.

Holotype ♂, allotype ♀ and 7 ♂ paratypes, Tioga Pass, Calif., July 31, 1940, R. H. Beamer.

Types in Snow Entomological Collections

## 27. *Delphacodes stramineosa* n. sp.

### **Brachypterous Form:**

Resembling *Delphacodes hyalina* Bmr. but larger, without black between frontal carina, genital capsule light, aedeagus bent ventrally with rosette of spines at apex and with a pair of peculiar processes, one on each side of aedeagus at base. Length ♂ 2.4 mm.; ♀ 3.2 mm.

**Structure:** Front twice as long as wide, widest near middle, barely narrowed toward each end, base slightly wider than apex, tricarinate, median carina quite broad; crown almost square, slightly longer than wide, carinae definite but blunt; elytra extending to slightly beyond middle of abdomen, apices broadly rounded, veins raised, often sparsely set with dark setae; hind wings absent.

**Color:** General color stramineous, male with large anal processes black, female with a black triangular plate at base of ovipositor.

**Genitalia:** In lateral view pygofer slightly wider than long with a rounded protruding lobe on caudo-ventral corner; anal segment with a pair of very

large, curving, sharp processes; aedeagus, with sides almost parallel, about five times as long as wide, slightly curved ventrally throughout, with a rosette of spines at apex and at base a pair of slender, caudally-curving processes almost as long as aedeagus; aedeagal brace quite large; styles short, widest at base, almost straight, narrowed to knobbed apex. In caudal view styles about as in lateral except appearing longer; aedeagal brace broad with U-shaped median notch.

Holotype ♂, allotype ♀, 22 ♂ and 53 ♀ paratypes, Storrs, Conn., Aug. 4, 1946, R. H. Beamer; other paratypes; 15 ♂♂ and 30 ♀♀, same place and collector, Aug. 3, 1946; 8 ♂♂ and 16 ♀♀, same place and collector, Aug. 15, 1946; 1 ♂ and 10 ♀♀, Water Mill, Long Island, N.Y., Aug. 18, 1496, R. H. Beamer.

Types in Snow Entomological Collections.

## 28. *Delphacodes serrata* n. sp.

### Brachypterous Form:

Resembling *Delphacodes alexanderi* (Metc.) but elytra not reaching beyond middle of abdomen, crown much longer than wide, female with black between lateral carinae only at union of front and crown and aedeagus bent dorsally with dorsal edge serrate. Length ♂ 2.2 mm.; ♀ 2.7 mm.

**Structure:** Front slightly more than twice as long as wide, widest on basal third, narrowed very gently throughout most of its length, then rather suddenly at apex and base, more so at base; crown about twice as long as wide, carinate, raised above level of eyes more than normal; elytra not reaching more than to middle of abdomen, veins raised, apices semitruncate; hind wings triangular pads, less than half as large as an eye.

**Color:** General color stramineous, male with dark spot above hind coxae, vittae between carinae of front black, elytra and abdomen black except large basal spot and some small lateral spots on dorsum of abdomen lighter; female varies from stramineous to buff, two short black stripes arising near base of front between carinae and ending near middle of crown, tips of tarsi and ovipositor darker, elytra almost hyaline.

**Genitalia:** In lateral view pygofer more or less rectangular, ventral margin about one fourth longer than dorsal; anal segment with a pair of

## PLATE V

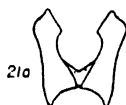
21. Lateral view of genital capsule of male of *Delphacodes trimaculata* Beamer
- 21a Caudal view of styles and aedeagal brace of *Delphacodes trimaculata* Beamer.
- 21b Lateral view of aedeagus enlarged of *Delphacodes trimaculata* Beamer
22. Lateral view of genital capsule of male of *Delphacodes penepuella* Beamer
- 22a Caudal view of styles and aedeagal brace of *Delphacodes penepuella* Beamer.
- 22b Lateral view of aedeagus enlarged of *Delphacodes penepuella* Beamer
23. Lateral view of genital capsule of male of *Delphacodes recurvata* Beamer.
- 23a Caudal view of styles and aedeagal brace of *Delphacodes recurvata* Beamer
- 23b Lateral view of aedeagus enlarged of *Delphacodes recurvata* Beamer.
24. Lateral view of genital capsule of male of *Delphacodes incurva* Beamer.
- 24a Caudal view of styles and aedeagal brace of *Delphacodes incurva* Beamer.
- 24b Lateral view of aedeagus enlarged of *Delphacodes incurva* Beamer.
- 24c. Lateral view of inner margin of one of anal spines of *Delphacodes incurva* Beamer.
25. Lateral view of genital capsule of male of *Delphacodes latidens* Beamer.
- 25a. Caudal view of styles and aedeagal brace of *Delphacodes latidens* Beamer
- 25b. Lateral view of aedeagus enlarged of *Delphacodes latidens* Beamer



*D. trimaculata*



21b



21a



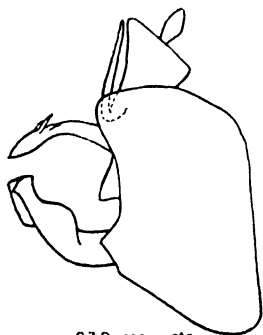
*22 D. penepuella*



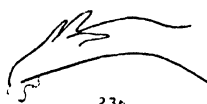
22a



22b



*23 D. recurvata*



23b



23a



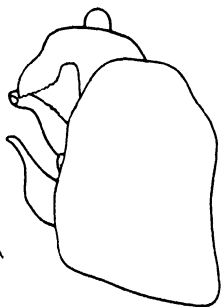
*24 D. incurva*



24b



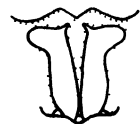
25a



*25 D. latidens*



25b



24a



24c



rather straight sharp processes about as long as segment; aedeagus widest at base, evenly narrowed throughout and curved dorsally with apical third slightly turned caudally, dorsal margin serrate; styles almost hidden from view in the deep pygofer. In caudal view styles of normal length, widest at base, margins sinuous and narrowing to sharp apices; aedeagal brace in form of a narrow rectangular lobe at middle of broadly rounded opening.

Holotype ♂, allotype ♀, 23 ♂ and 21 ♀ paratypes, Storrs, Conn., Aug. 2-4, 1946, R. H. Beamer; 1 pair paratypes, South Dayton, N. Y., July 23, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

### 29. *Delphacodes opaca* n. sp.

#### Brachypterous Form:

Resembling *Delphacodes atrata* Osb. but much smaller, darker in color, elytra not extending beyond middle of abdomen and aedeagus of male bifid for half its length. Length ♂ 1.4 mm.; 1.7 mm.

**Structure:** Front less than twice as long as wide, widest beyond middle, sides evenly curved toward each end, strongly tricarinate; crown almost as long as wide, front wider than base, carina present, stronger on basal half; elytra about as wide as long, reaching about to middle of abdomen, apices semitruncate, veins raised.

**Color:** General color dark brown to black throughout, region of hind coxae and caudal excavation of male genital capsule lighter.

**Genitalia:** In lateral view pygofer more or less rectangular with ventral margin almost twice as long as dorsal; anal segment with a pair of sinuate processes about as long as segment; aedeagus widest at base, more than half as wide as long, curved dorsally, bifid for more than half its length, ventral portion with two teeth near tip and three smaller ones near base; styles barely visible in this view. In caudal view pygofer margin flared, deeply excavated; styles widest near base, sinuate with margins parallel to outer third where they narrow rapidly to sharp apices; aedeagal brace heavy with angular bifid apex.

Holotype ♂, allotype ♀, 7 ♂ and 4 ♀ paratypes, Willimantic, Conn., Aug. 8, 1946, R. H. Beamer; other paratypes, 14 ♂ ♂ and 8 ♀ ♀, Storrs, Conn.,

### PLATE VI

26. Lateral view of genital capsule of male of *Delphacodes lutulentoides* Beamer.
- 26a. Caudal view of styles and aedeagal brace of *Delphacodes lutulentoides* Beamer.
- 26b. Lateral view of aedeagus enlarged of *Delphacodes lutulentoides* Beamer.
27. Lateral view of genital capsule of male of *Delphacodes stramineosa* Beamer.
- 27a. Caudal view of styles and aedeagal brace of *Delphacodes stramineosa* Beamer.
- 27b. Lateral view of aedeagus enlarged of *Delphacodes stramineosa* Beamer.
28. Lateral view of genital capsule of male of *Delphacodes serrata* Beamer.
- 28a. Caudal view of styles and aedeagal brace of *Delphacodes serrata* Beamer.
- 28b. Lateral view of aedeagus enlarged of *Delphacodes serrata* Beamer.
29. Lateral view of genital capsule of male of *Delphacodes opaca* Beamer.
- 29a. Caudal view of styles and aedeagal brace of *Delphacodes opaca* Beamer.
- 29b. Lateral view of aedeagus enlarged of *Delphacodes opaca* Beamer.
30. Lateral view of genital capsule of male of *Delphacodes livida* Beamer.
- 30a. Caudal view of styles and aedeagal brace of *Delphacodes livida* Beamer.
- 30b. Lateral view of tip of aedeagus enlarged of *Delphacodes livida* Beamer.



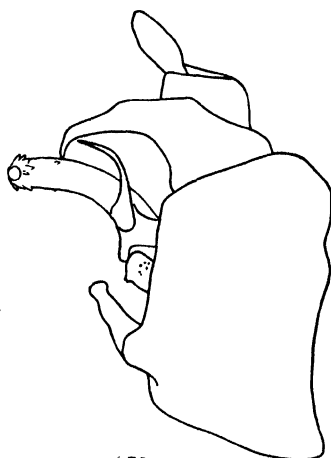
26D. *lufulentoides*



26b



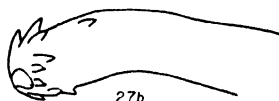
26a



27D. *stramineosa*



27a



27b



28b



28D. *serrata*



29b



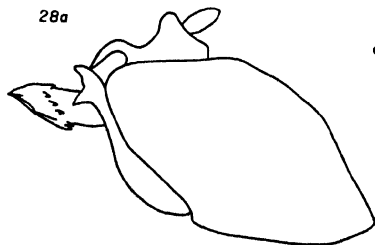
29D. *opaca*



28a



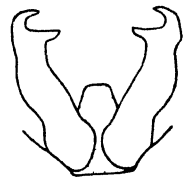
29a



30D. *livida*



30b



30a

Aug. 2-15, 1946, R. H. Beamer; 6 ♂♂ and 5 ♀♀, Dingman's Ferry, Pa., Aug. 20, 1946, R. H. Beamer; 1 ♂, Mt. Lake, Va., Sept. 2, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

### 30. *Delphacodes livida* n. sp.

#### Brachypterous Form:

Resembles *Delphacodes acuministyla* Dozier but distinctly larger, black in color and male styles in caudal view with bifid, more or less U-shaped apices. Length ♂ 2.0 mm. ♀ 2.2 mm.

**Structure:** Front almost twice as long as wide; widest near apical third, gently narrowed toward each end, apex wider than base, tricarinate; crown definitely longer than wide, carinate with those on anterior half indistinct; elytra reaching slightly beyond middle of abdomen, apices broadly rounded in female, slightly more truncate in male, hind wings triangular pads about one third as large as eye.

**Color:** General color light brown to black; legs, front in some specimens, crown and antennae light brown, elytra, most of abdomen and genital capsule shining black, anal tube, small portion of dorsum of last abdominal segment light.

**Genitalia:** In lateral view pygofer more or less trapezoidal; anal segment with a pair of curved, sharp processes arising on outer lower corner; aedeagus widest near outer third, shaft almost straight, with a diagonal circle of teeth at widened spot; styles widest at base, narrowing to bifid apices. In caudal view styles widest at base, outer margin sinuate, apices bifid, U-shaped; aedeagal brace fair sized with apex blunt or slightly excavated.

Holotype ♂, allotype ♀; 27 ♂ and 1 ♀ paratypes, Storrs, Conn., Aug. 5-15, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

## NOTES ON THE BEET LEAFHOPPER, *Circulifer tenellus* (Baker),<sup>1</sup> AND ITS RELATIVES (Homoptera: Cicadellidae)

P. W. OMAN

Bureau of Entomology and Plant Quarantine  
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U. S. Department of Agriculture

It is the purpose of the present paper to define the genus *Circulifer* Zakhvatkin and to discuss briefly the Old World distribution of *tenellus* and its other components. Notes on the identity of some of the species of *Circulifer* are given, but it is not possible at this time, with the limited material available, to undertake a critical study of the genus. There is included a "check list" of trivial names assigned to *Circulifer*.

It has long been recognized that *tenellus* was not properly placed in the genus *Eutettix*, that generic name being applicable only to a group of rather robust, oak feeding species from which *tenellus* differs very markedly in a number of characters. The apparent absence, from the Nearctic region, of species closely related to *tenellus* led naturally to the examination of avail-

<sup>1</sup> Commonly referred to in North American literature as *Eutettix tenellus* (Baker).

able material from other faunal regions in an attempt to resolve the correct generic position of the beet leafhopper. As a result of those studies it became evident that *tenellus* should be associated with a number of southern European species, for which Zakhvatkin in 1935 proposed the name *Circulifer*. Although the designation "*Eutettix tenellus*" has been continued in North America for more than ten years as a matter of convenience until certain problems of distribution could be clarified, it now seems desirable to adopt the generic designation which will emphasize the Old World distribution and relationships of *tenellus*.

#### THE GENUS *CIRCULIFER* ZAKHVATKIN

*Circulifer* Zakhvatkin, Wiss. Ber. Moskauer Staats Univ. 4:111, 1935. Type, by original designation, *Jassus haematocephus* Mulsant and Rey, 1855.

*Distomotettix* Ribaut, Soc. Hist. Nat. Toulouse Bul. 72: 97, 1938. Type, by original designation, *Jassus fenestratus* Herrich-Schaeffer, 1834.

Small leafhoppers, total length 2.75-4.00 mm. Head slightly wider than pronotum, anterior margin rounded, crown short and convex. Clypellus slender, constricted basad of middle. Lateral margins of genae sinuated below eyes. Ocelli near eyes. Lateral margins of pronotum short. Forewing with appendix well developed; apical cells short; outer antepical cell small, usually elongate-ovate in shape; central antepical cell constricted; inner antepical cell open basally. Hind wing with four apical cells. Aedeagus symmetrical and having two orifices; ejaculatory duct bifurcate. Pygofer of male with a dorsally directed, sharp, spine-like process.

The typical members of the genus, of which *tenellus* is one, have the following features supplementary to the characters given above. Distal processes of the aedeagus forming a complete or nearly complete circle, posterior margin of sternite VII of female sinuated and with a brown-bordered median emargination. In contrast to the typical forms, *C. fenestratus*, type of *Distomotettix*, has the distal processes of the aedeagus shorter, forming but a semicircle, and the posterior margin of sternite VII of the female without a median emargination. Further study may indicate the desirability of retaining *Distomotettix* as a subgenus, especially if other species are found to have the same type of genital structures.

The Old World distribution of typical members of the genus *Circulifer* may be given as follows: the countries of southern Europe adjacent to the Mediterranean, the Balkan states, northern Africa, Yemen, Palestine, northern Arabia, the area around the Caspian Sea, the Punjab district of north India, and the deserts and arid regions of Asia from the Persian Gulf to the northeast as far as the steppe of Balagansk in south central Siberia. It is of interest to note that the distribution outlined involves an area that is ecologically very similar to that occupied by the beet leafhopper in North America. It is not clear from published records whether or not members of the genus occur to the east of the Tian-Shan range in Chinese Turkestan. *Circulifer fenestratus* (H-S.), in addition to occupying a considerable portion of the range outlined above, occurs much farther north in Europe than do the typical members of the genus, and is known from Germany, central Russia, and Finland.

**CIRCULIFER TENELLUS (Baker)**

*Thamnotettix tenellus* Baker, *Psyche* 7 (suppl.): 24, 1896.

*Thamnotettix rubicundula* Van Duzee, *Buffalo Soc. Nat. Sci. Bul.* 8 (5): 70, 1907.

*Thamnotettix ignavus* Matsumura, *Jour. College Sci., Imp. Univ. Tokyo* 23: 22, 1908.  
(New synonymy, new combination).

*Thamnotettix indivisus* Haupt, *Palestine Agric. Exp. Sta. Bul.* 8: 35, 1927.

At the time I suppressed *indivisus* as a synonym of *tenellus*<sup>2</sup> there existed some slight doubt as to the source of Haupt's material. There no longer seems reason to doubt that Haupt's specimens came from Palestine, and in the absence of evidence to indicate the specific distinctness of *indivisus* I retain that name in synonymy, although Ribaut<sup>3</sup> lists it as distinct. Recently I have been able to study a specimen of *ignavus* Matsumura,<sup>4</sup> described from Sicily. This specimen, presumably a syntype, is a typical example of *tenellus*. This record establishes beyond question the fact that *tenellus* occurs in the Mediterranean area. It seems probable that other records of forms from the Old World also apply to *tenellus*. On the basis of the description given, *salus* (Matsumura) described from Sicily, may be *tenellus*. The characters of sternite VII of the females, as illustrated by Zakhvatkin for the Yemenian specimens described as *chinai*, *arabicus*, and *jenjouriste*, come within the observed range of variation of that structure in *tenellus*. Zakhvatkin gives no characters for these species that will differentiate them from *tenellus* and does not describe the male sex.

The accompanying illustrations (fig. 1) of the inner male genital structures and sternite VII of the female of *tenellus* will serve well to depict the general nature of those parts in typical members of the genus. The distal processes of the aedeagus do not lie in the same plane as the shaft of the aedeagus, and when viewed at right angles to the plane in which they lie they form an almost perfect circle. The shape of the male plates appears to be relatively constant within a species and hence useful in specific differentiation. The shape of sternite VII of the female is subject to considerable variation with respect to the degree of sinuation of the posterior margin and the depth and shape of the median emargination, but this structure may also be useful in distinguishing between related species once the extent of variation is determined.

***Circulifer nausharensis* (Pruthi), new combination**

Through the courtesy of Dr. B. N. Chopra, Director, Zoological Survey of India, I was able to examine two female specimens of *nausharensis*, described from material collected in the Punjab district of north India. These specimens are typical of the genus *Circulifer* and differ from *tenellus* in having the median emargination of sternite VII shallow and subquadrate. The male plates, as described and figured by Pruthi, are triangular in outline, similar to those of *vittiventris* (Lethierry).

<sup>2</sup>Ent. Soc. Washington *Trans.* 38 (7): 164-165, 1936.

<sup>3</sup>Soc. Hist. Nat. Toulouse *Bul.* 77: 12, 1942.

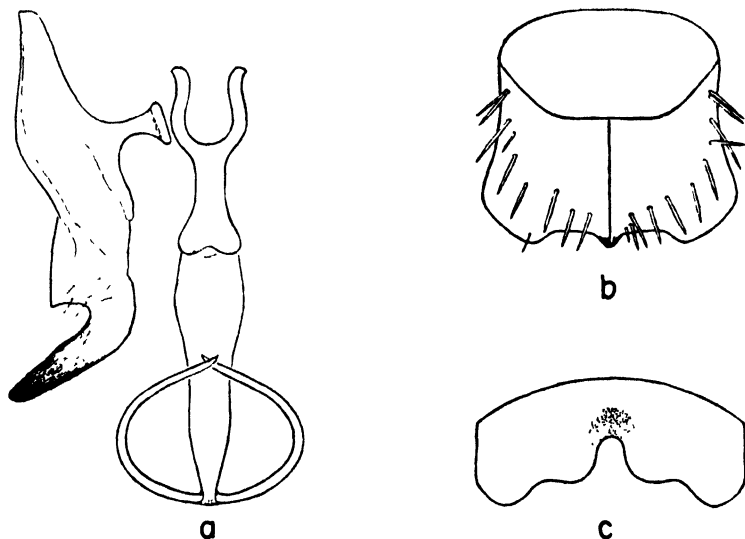
<sup>4</sup>I wish to express my sincere appreciation to Major J. E. Webb, Jr., whose assistance made the study of specimens from the Matsumura collection possible. I also thank Dr. Toichi Uchida and Dr. T. Inukai, of the Hokkaido Imperial University, Japan, for their cooperation in arranging the loan of this material.

**Circulifer dubiosus (Matsumura)**

Four specimens, presumably syntypes of this species which was described from Sicily and Tangier, Spanish Morocco, were sent to me from the Matsumura collection by Major Webb. *C. dubiosus* is closely related to *tenellus* but differs in being slightly more robust, having the median emargination of sternite VII of the female deeper, the male plates larger and subtruncate, and the terminal portion of the male styles stouter.

The following check list of representatives of the genus *Circulifer* has been compiled for the most part from literature. I have omitted *Cicadula flaveola* Matsumura, 1908, since there exists some doubt that it is a *Circulifer* although tentatively assigned to the genus by Zakhvatkin.<sup>5</sup> It is probable that still other described species will be placed in this genus when the fauna of western Asia is better known.

Ribaut<sup>6</sup> apparently considers *alboguttatus* (Lethierry), *guttulatus* (Kirschbaum), and *indivisus* (Haupt) as valid species. In my discussion of *tenellus* I have indicated my reason for retaining *indivisus* as a synonym of that species. On the basis of the scanty material studied, I consider *alboguttatus* and *guttulatus* but variants of *fenestratus*, a conclusion in agreement with the past treatment of these forms by European workers.

**EXPLANATION OF FIGURE 1**

Details of *Circulifer tenellus* (Baker): a, style, connective, and aedeagus, ventral view; b, male plates; and c, sternite VII of female.

<sup>5</sup>Wiss. Ber. Moskauer Staats Univ. 4:111, 1935.

<sup>6</sup>Soc. Hist. Nat. Toulouse Bul. 77: 12, 1942.

CHECK LIST OF TRIVIAL NAMES ASSIGNED TO THE GENUS *CIRCULIFER*

*alboguttatus* (Lethierry) = *fenestratus* (Herrich-Schaeffer)

*arabicus* Zakhvatkin

*Circulifer arabicus* Zakhvatkin, Royal Ent. Soc. London Trans. 96: 161, 1946

*caspius* Zakhvatkin = *chinae* Zakhvatkin

*chinae* Zakhvatkin

*Circulifer chinae* Zakhvatkin, Royal Ent. Soc. London Trans. 96: 160, 1946.

*Circulifer chinae* subsp. *caspius* Zakhvatkin, Royal Ent. Soc. London Trans. 96: 160, 1946.

*dubiosus* (Matsumura)

*Thamnotettix dubiosus* Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 18, 1908.

*fasciatus* (Ferrari) = *fenestratus* (Herrich-Schaeffer).

*fenestratus* (Herrich-Schaeffer)

*Jassus fenestratus* Herrich-Schaeffer, in Panzer, Faunae Insectorum Germanicae Initia oder Deutschlands Insecten, heft 122: 5, 1834.

*Jassus* (*Deltocephalus*) *guttulatus* Kirschbaum, Jahrb. Ver. Nat. Nassau, 21-22: 126, 1866.

*Thamnotettix alboguttata* Lethierry, Petite Nouvelles Ent. 1: 444, 1874.

*Thamnotettix fenestrata* var. *transversalis* Puton, Mitth. Schw. Ent. Ges. 6: 129, 1881

*Thamnotettix fenestrata* var. *fasciata* Ferrari, Bul. Soc. Ent. Ital. 17: 288, 1885

*Thamnotettix fenestrata* var. *venosa* Ferrari, Rev. d'Ent. 4: 59, 1885.

*guttulatus* (Kirschbaum) = *fenestratus* (Herrich-Schaeffer).

*haematoceps* (Mulsant and Rey)

*Jassus haematoceps* Mulsant and Rey, Ann. Soc. Linn. Lyon (2) 2: 229, 1885.

*Jassus* (*Deltocephalus*) *rubrotinctus* Kirschbaum, Jahrb. Ver. Nat. Nassau, 21-22: 125, 1866.

*Jassus* (*Deltocephalus*) *opacus* Kirschbaum, Jahrb. Ver. Nat. Nassau, 21-22: 126, 1866.

*Thamnotettix opaca* var. *minor* Ferrari, Ann. Mus. Genova (2) 1: 514, 1864

*haupti* Zakhvatkin

*Thamnotettix unicolor* Haupt, Palestine Agric. Exp. Sta. Bul. 8: 34, 1927, not *Cicadula unicolor* Melichar, 1902

*Circulifer haupti* Zakhvatkin, Moscow Univ. Sci. Proc. 4: 111, 1935.

*ignavus* (Matsumura) = *tenellus* (Baker)

*indivisus* (Haupt) = *tenellus* (Baker).

*inscriptus* (Haupt)

*Thamnotettix inscriptus* Haupt, Palestine Agric. Exp. Sta. Bul. 8: 33, 1927.

*jenjouriste* Zakhvatkin

*Circulifer jenjouriste* Zakhvatkin, Royal Ent. Soc. London Trans. 96: 161, 1946

*minor* (Ferrari) = *haematoceps* (Mulsant and Rey).

*nausharensis* (Pruthi)

*Cicadula nausharensis* Pruthi, Mem. Indian Mus. 11(3): 113-114, 1936

*opacus* (Kirschbaum) = *haematoceps* (Mulsant and Rey).

*rubicundula* (Van Duzee) = *tenellus* (Baker)

*rubrotinctus* (Kirschbaum) = *haematoceps* (Mulsant and Rey).

*salus* (Matsumura) (new combination).

*Thamnotettix salus* Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 21, 1908

*tenellus* (Baker)

*Thamnotettix tenellus* Baker, Psyche 7 (suppl.): 24, 1896.

*Thamnotettix rubicundula* Van Duzee, Buffalo Soc. Nat. Sci. Bul. 8(5): 70, 1907.

*Thamnotettix ignavus* Matsumura, Jour. College Sci., Imp. Univ. Tokyo 23: 22, 1908.

*Thamnotettix indivisus* Haupt, Palestine Agric. Exp. Sta. Bul. 8: 35, 1927

*transversalis* (Puton) = *fenestratus* (Herrich-Schaeffer).

*unicolor* (Haupt) = *haupti* Zakhvatkin.

*unicolor* (Melichar)

*Cicadula unicolor* Melichar, Wien. Ent. Zeit. 21: 78, 1902.

*venosus* (Fleber) = *fenestratus* (Herrich-Schaeffer).

*vittiventris* Lethierry

*Cicadula vittiventris* Lethierry, Soc. Ent. Belg. Ann. 19, C. R. p. lxxxiv, 1876.

## THE SEVENTEENTH OR 1947 ANNUAL INSECT POPULATION SUMMARY OF KANSAS<sup>1</sup>

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Kansas Agricultural Experiment Station

This insect population summary for Kansas covers the calendar year 1947 and is the 17th in a continuous series which began with the year 1931.<sup>4</sup> The information recorded here is based on a summary of 307 questionnaires of the score card type from the sources indicated in Table I, together with the observations and comments of the authors and their colleagues and of those returning the score sheets.<sup>3</sup>

**TABLE I.**

**Source and Numbers of Questionnaires Summarized for This Report.**

	No. in July	No. in October
Group 1. Entomologists in the State	8	12
Group 2. County Agricultural Agents	73	79
Group 3. Farmers, mostly college graduates	9	28
Group 4. Vocational Agriculture Teachers	27	50
Group 5. Agronomists and Horticulturists	9	12
Total reports of each groups	126	181
Grand total of all questionnaires summarized for this report	307	
Number of counties reporting	97	

### Summary of Weather Conditions (Fig. I and Table II) in Kansas by Months During 1947<sup>5</sup>

**January** averaged mild and pleasant with more sunshine and less precipitation than usual. It opened with rather heavy snows and some of the coldest weather ever known in the eastern part of the state on the 4th. Snowfall was heavier than usual and was well distributed over the state but the total fall of moisture was generally deficient, except in some western counties where it was slightly above normal. Soil moisture conditions continued ample for current needs except in some south-central counties. Wheat remained in excellent condition and made some growth during the mild weather.

<sup>1</sup> Contribution No. 561 from the Department of Entomology

<sup>2</sup> Entomologists of the Kansas Agricultural Experiment Station.

<sup>3</sup> Recognition and appreciation for assistance given during the preparation of this summary are due to the same sources and largely to the same individuals who supplied information for recent, previous reports. The questionnaires were sent to the county agents by E. G. Kelly, extension entomologist, who also read the manuscript critically.

<sup>4</sup> For the other summaries in this series, see the *Journal of the Kansas Entomological Society* for the summaries for 1931 (vol. 5); 1932 (Vol. 6); 1933 (vol. 7); 1936 (vol. 10); 1937 (vol. 11); 1939 (vol. 13); 1942 (vol. 16); 1943 (vol. 17); 1944 (vol. 18); 1945 (vol. 19); and for 1946 (vol. 20). The *Transactions of the Kansas Academy of Science* for 1934 (vol. 38); 1935 (vol. 39); 1938 (vol. 42); 1940 (vol. 44); and for 1941 (vol. 45).

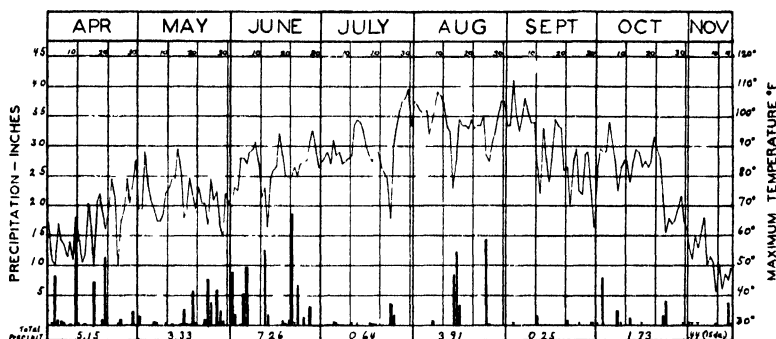
<sup>5</sup> Notes and Table II based on Climatological Data: Kansas Section Weather Bureau, U. S. Dept. of Commerce by S. D. Flora. Vol. 61, 1947.



**TABLE II**  
**Summary of Weather Data for the State of Kansas for the period September 1, 1946 to December 31, 1947.**  
 From U. S. Weather Bureau, Kansas Section, Vol. 61.

Temperature in degrees Fahrenheit				Precipitation in inches							
Month	State Mean	Maximum	Minimum	Mean for 61 years	Departure from normal	State Average	Average for 61 years	Departure from normal	Eastern third	Middle third	Western third
1946											
September	68.9°	107°	27°	69.7°	-0.8°	3.66	2.86	+0.80	4.27	3.80	2.99
October	58.4°	92°	25°	57.3°	+1.1°	4.22	1.99	+2.23	2.99	3.81	5.87
November	42.9°	77°	5°	43.3°	-0.4°	2.56	1.27	+1.29	2.34	2.29	3.05
December	38.7°	78°	-12°	33.1°	+5.6°	0.57	0.89	-0.32	1.26	0.42	0.04
1947											
January	32.9°	75°	-35°	30.1°	+2.8°	0.58	0.70	-0.12	0.63	0.57	0.53
February	31.4°	78°	-9°	33.3°	-1.9°	0.32	0.98	-0.66	0.40	0.32	0.24
March	39.0°	86°	-14°	43.5°	-4.5°	2.47	1.48	+0.99	3.63	2.36	1.42
April	52.5°	91°	21°	54.8°	-2.3°	4.67	2.71	+1.96	7.17	4.63	2.21
May	60.9°	96°	27°	63.8°	-2.9°	4.50	3.81	+0.69	4.85	4.42	4.23
June	71.8°	105°	36°	73.8°	-2.0°	5.20	4.03	+1.17	7.11	5.24	3.25
July	77.6°	111°	45°	79.2°	-1.6°	1.91	3.10	-1.19	2.06	1.72	1.96
August	83.2°	111°	52°	78.0°	+5.2°	1.84	3.15	-1.31	2.26	1.54	1.73
September	74.0°	117°	30°	69.8°	+4.2°	1.40	2.83	-1.43	3.27	0.47	0.46
October	65.8°	104°	25°	57.5°	+8.3°	1.29	1.98	-0.69	2.11	1.06	0.69
November	39.5°	72°	-8°	43.2°	-3.7°	1.15	1.27	-0.12	1.38	1.06	1.01
December	34.5°	73°	-6°	33.1°	+1.4°	2.07	.89	+1.18	2.71	2.33	1.16
Averages, totals or extremes											
for 1947	55.2°	117°	-35°	55.0°	+0.2°	27.43	2.25	+0.48	37.60	25.74	18.94

**February** was the coldest experienced in Kansas since 1939 and had less precipitation than any other February in 11 years. The three-month winter period, which it completed, was the driest in 11 years and the sixth driest winter the state has experienced in 60 years. The top soil was dry, and dust storms occurred on the 6th and on a few other days in western counties. Wheat was largely dormant and made little growth. Abnormally cold weather occurred the last 10 days of the month. The main precipitation occurred from snows of the 7th and 28th.



**Fig. 1.** Daily rainfall and temperature chart for the growing season of 1947, at Manhattan, Kansas. Chart prepared by D. A. Wilbur.

**March** was unusually cold, cloudy, and wet, but wheat made good growth the latter part of the month. Rains and snows were more frequent than usual and precipitation was well above normal, except in some extreme western counties.

**April** was a cool, rainy, cloudy month. The spring was cold, wet, cloudy, and from two to four weeks late. It was the 5th wettest April in 61 years. There were a few days in the eastern half of the state when the soil was dry enough for working. Wheat, alfalfa, and blue grass made excellent growth, but the planting of corn, oats, and barley was delayed. Fruit bloom appeared later than usual and bees had few days for flight. Peaches were practically all frozen in January. Warm, sunny weather was needed.

The 35° F. below zero weather in January, or late freezes in April, caused extensive killing above ground of arbor vitae. Many hedges were killed completely and individual trees in nurseries and around homes either were killed or showed many dead branches. No such extensive killing of arbor vitae by freezing weather had occurred within the memory of observers.

**May** was cool and wet. It was the fourth consecutive month with below normal temperatures, and rain fell some place in the state practically every day in the month. Freezing weather on the 29th established new low temperature records in many places in the state. Wheat continued in excellent condition, except for injury from freezing in Smith, Osborne, and Phillips counties.

**June** was characterized by excessively wet weather except in the south-west and south-central counties. Temperatures averaged below normal and cloudiness was excessive. Rains were unusually frequent, falling in some part of the state every day of the month.

**July** had sufficient rainfall in nearly every part of the state and temperatures averaged below normal. The month closed with a hot spell of almost record-breaking severity.

**August** was the hottest for this month the state had experienced since 1937 and the driest since 1936. Rains were infrequent and temperatures rose above 100° F. on from 10 to 15 days in nearly all parts of the state. Nights were abnormally warm for the time of year. There were few cool periods during the month. Corn began to deteriorate early in the month, and, by the latter part of August, much was damaged beyond recovery. Grain sorghums were retarded, but preparation of the soil for wheat progressed well. Pastures deteriorated greatly in regions of scanty rainfall.

**September** was above normal in temperature and deficient in rainfall, making this one of the driest on record. Wheat sowing made little progress, pastures dried up, and corn deteriorated further.

**October** was the warmest on record and was deficient in rainfall, especially over the western counties. For the state as a whole, the three-month period ending with October was the driest on record, with the exception of 1939. Over the western third, it was the fourth driest in 60 years. Sowing wheat made good progress over the eastern half of the state, but much of the intended acreage was not seeded due to lack of soil moisture.

**November** was exceptionally cool and cloudy, with frequent light rains. The first killing frosts occurred in the eastern two-thirds of the state on the 5th and 12th, which are unusually late dates.

**December** had a heavier fall of moisture than any month since June. Temperatures were mild for the time of year. It was a favorable month for wheat and livestock.

### **CROP PRODUCTION SUMMARY FOR 1947<sup>6</sup>**

The total acreage of all crops harvested in 1947 was 23,586,000 acres compared with 22,559,000 acres in 1946. The total farm value of all Kansas crops produced in 1947 of \$930,275,000 was the highest on record and compared with the 1946 crop production value of \$640,928,000. The Kansas 1947 wheat production of 286,702,000 bushels exceeded the previous largest crop in 1931 by 34,817,000 bushels. It was the largest acreage ever harvested with a per acre yield which had not been exceeded since 1914. The 1947 wheat crop value was placed at \$673,750,000.

Conditions for seeding winter wheat in the fall of 1946 were very favorable and moisture supplies for development of the crop were adequate for abundance throughout the season. Condition for planting and growth of corn, oats, and other spring planted crops, however, were unfavorable. An

<sup>6</sup> From Kansas 1947 Crop Review, Kansas State Board of Agriculture, Statistics Division, December 19, 1947 Mimeographed Release

unusually late, wet spring delayed plowing and planting, after which the weather turned off unusually hot and dry during the summer and fall. This resulted in poor yields, with considerable acreage of corn and sorghums having to be cut for forage and silage and relatively large abandonment occurring in some sections. A late fall with dry open weather permitted harvest of late crops without material loss or damage from frost.

**Corn and other crops.** Corn planting was delayed by the late, wet spring, and the crop was severely damaged by the hot, dry August weather. Corn production was estimated at 40,443,000 bushels, compared with 63,231,000 bushels in 1946, and was the smallest crop since 1939. Harvested acreage was down 21 per cent from 1946. Average yield per acre was 17 bushels, while the average yield per acre for 1946 was 21 bushels. Production of **sorghums** for grain was estimated at 10,933,000 bushels compared with 11,488,000 bushels in 1946, which was the smallest crop since 1939. Sorghum forage production of 1,385,000 tons compared with 2,083,000 tons in 1946. **Oats** production was estimated at 40,455,000 bushels which was only slightly less than in 1946, and compared with the 10-year average of 35,942,000 bushels. **Barley** production at 6,380,000 bushels compared with 5,022,000 bushels last year and the 10-year average of 12,051,000 bushels.

**Soybeans and Flaxseed**—the 1947 soybean production was estimated at 1,887,000 bushels compared with 2,178,000 bushels in 1946. **Flaxseed** production was 749,000 bushels compared with 812,000 bushels in 1946. The flaxseed acreage was 8 percent less than in 1946.

**Hay and Seed Crops**—Kansas production of all hays totalled 3,116,000 tons, compared with 2,327,000 tons in 1946. There was increased acreage of alfalfa as well as a good crop. The alfalfa hay production, included in the above totals, was 1,981,000 tons in 1947, compared with 1,569,000 tons in 1946. The prairie or wild hay production, included in the above totals, was 772,000 tons compared with the crop of 478,000 tons in 1946. Said crops harvested this year and last year, respectively, were as follows: **alfalfa** 311,000 and 448,000 bushels; **red clover** 61,000 and 53,000 bushels; **sweet clover** 161,000 and 120,000 bushels, **lespedeza** 6,100,000 and 8,400,000 pounds; **Sudan grass** 2,100,000 and 1,600,000.

**Other Crops.** The Kansas production of potatoes was estimated at 1,188,000 bushels, compared with 1,632,000 in 1946 and the 10-year average of 2,200,000 bushels. **Broom corn** production at 1,100 tons was sharply below the 1946 production of 1,700 tons. **Popcorn** production in 1947 of only 2,660,000 pounds was sharply below the 1946 production of 6,240,000 pounds. Kansas had a good season for **apples**, with a commercial crop of 755,000 bushels compared with 514,000 in 1946; it was the largest crop since 1940. Production of other fruit this year and last year were as follows: **peaches** 12,000 and 154,000 bushels; **pears** 99,000 and 90,000 bushels; **grapes** 1,900 tons and 1,600 tons.

**Honey Crop.** The estimated honey crop for 1947 was 2,560,000 pounds, or an average yield of 40 pounds per colony, compared with 3,360,000 pounds, or an average yield of 56 pounds per colony, in 1946. The amount of **beeswax** for 1947 was 54,000 pounds, compared with 67,000 pounds in 1946.

## DESCRIPTIVE ACCOUNT OF THE MORE IMPORTANT INSECT ACTIVITIES AND CLIMATIC RELATIONSHIPS DURING 1947

**Ants** were approximately as numerous and annoying in the spring and summer, as usual, but the swarming species prompted somewhat more inquiries than usual during the fall. The yellow ant caused fewer inquiries in the spring, but swarms of the little black ant, pavement ant, the acrobat ant, and perhaps some other species reached peak numbers during October.

**Aphids** were about equal to 1946 in population and, in general, probably normal in population, although the pea aphid and the green ash aphid attained considerable numbers. Aphids were scored at 3 on shrubs in Hamilton County; at 4 on sorghums in Haskell and Ellis counties; at 3 elms in Graham County; at 2 on melons and cucumbers in Atchison County, and from 2 to 4 on gardens and flowers in many counties.

**Fire blight**, which usually is regarded as being, in part, transmitted by aphids and other insects, was more abundant in orchards and nurseries during 1947 than in any other year since 1935.

**Aphids on snowball, chrysanthemums, and spiraea** were definitely less numerous than last year.

**Apple aphids** were plentiful in orchards in northeast Kansas, but good control was obtained by use of oil sprays and no damage was done.

**Green bugs** which are aphid pests of wheat and oats in the spring, were widely distributed in the state during April and May, but little damage occurred. The bugs were more plentiful in 1947 than in 1946. They reached considerable numbers on wheat by the latter part of May, but the crop was then too advanced for serious damage. Some growers ascribed thin, poor stands of wheat to green bugs, but this was not proved. Wheat grew so rapidly during May and June that it was doubtful whether these insects caused

### TABLE III.

Population summary of the more common and important insects in Kansas for 1947, as indicated by questionnaire score sheets from nearly all counties.

#### KEY

1. Scarce.
2. Plentiful, but damage was neither noticed nor reported.
3. The species was abundant. Some damage was either seen or reported.
4. Local outbreaks. The species was doing severe damage in certain fields.
5. The species was in general outbreak. The insects were doing their greatest damage or were as plentiful as they ever get in a locality.

NOTE: This table represents the population scorings by counties for each species of insect listed in the questionnaires, in so far as reported. To use it to best advantage, copy the scores for each species in the counties of a state map.

[illegible]

appreciable damage either to wheat or oats during the season, except in certain northwest counties. Many acres of stunted plants with poorly filled heads in Norton, Decatur, Graham, Rawlins, and Cheyenne counties were thought to have been injured by green bugs. Some fields were dusted with benzene hexachloride by planes. Lady beetles became so numerous by the later part of May that there were good reasons for believing that they were of first importance in controlling the green bug.

The **pea aphids** were more numerous than in 1945 or 1946. They attained damaging numbers over most of the state during early May and caused some injury to alfalfa, particularly in the western half of the state. Many fields, especially in southwestern counties, showed short, bunchy growths, particularly in spots, characteristic of the damage by this insect. The first cuttings in some fields in Ellis, Rice, Barton, and Pawnee counties were reported at nearly a total loss. Had growing conditions been poor, the first cutting of alfalfa would have been reduced and the quality lowered by pea aphids over most of the state; but the frequent rains enabled alfalfa to overcome an abnormally large population of these pests and relatively little loss in production or vigor of stands was observed or reported. The peak population was not reached until the first week of May, which is ordinarily too late for greatest injury to the crop.

Pea aphids were reported on peas in Douglas, Ellis, Meade, and Hamilton counties.

**Armyworms** developed in local outbreaks during May and June in wheat and oat fields in many areas in eastern Kansas. The species concerned were the wheat-head armyworm and the true armyworm. As usual, these larvae were mostly discovered in wheat that had lodged badly. Many statements of armyworm damage to corn, wheat, and alfalfa were reported by the press and radio. Specific localities of observed damage were at Lincoln, Hays, and elsewhere in central Kansas, and in Brown, Douglas, and Johnson counties. The wheat-head armyworm was reported in mid-June as causing extensive injury to the heads, leaves, and beards of wheat, oats, and brome grass.

**Bagworms** on evergreens, while common, were slightly less numerous and less destructive than in 1946. The reduction was probably due to the application of control measures. When uncontrolled in nurseries, they were common in the eastern three tiers of counties. They were reported for more western counties than in any of the last three years. Many evergreens were observed to have been killed by bagworms during 1946 and the trees had not yet been removed in 1947.

**Bean leaf beetles** were less numerous and destructive than in 1945 or 1946. They became abundant and destructive only to the foliage of late beans. They were noted in greatest numbers in the eastern third of the state in July and August.

**Black flies** were reported to be a pest of livestock in Pottawatomie County in mid-April.

**Blister beetles** had about the same population in 1947 as in the two previous years. They were not particularly numerous or troublesome in gardens

or on field crops. The striped species was numerous in many small areas in alfalfa fields. Blister beetles were reported damaging alfalfa in Brown, Woodson, Labette, Cloud, and Finney counties, and in gardens in Doniphan, Wyandotte, Woodson, Scott, and Gray counties.

**Bees** produced only about half a crop of honey in the region of Manhattan, but a full, normal crop was obtained in southeast Kansas. Bees were severely handicapped during the cold, wet, late spring because there were so few days they could fly, and maple, fruit tree, and dandelion blooms came later than usual. Many colonies had to be fed. In the region of Manhattan, they were not self-sustaining until early June. The large amount of rainy weather during June prevented maximum nectar gathering and the hot dry weather which arrived about mid-July cut off the nectar flow sharply. There was no fall nectar flow in many localities.

**Borers** in fruit and shade trees were equal to the numbers reported the two previous years. The hot, dry weather after mid-July favored them. Borers were reported in **peach** trees in Doniphan, Wyandotte, Neosho, Nemaha, Cowley, and Reno counties; in **apple** trees in Nemaha, Wyandotte, Johnson, and Woodson counties; in **cherry** trees in Nemaha, Neosho, and Cowley counties; in **locust** trees in Anderson and Meade counties; in **poplar** and **cottonwood** trees in Clay and Kiowa counties; in **elms** in Norton, Scott, and Gray counties; and in other trees in Russell and Ellis counties.

**Bot flies** were scored lower and reported from fewer counties in 1947 than for the two previous years. The decline in the number of horses may be responsible for the gradual reduction of the numbers of bot flies.

**Boxelder bugs** were more numerous and annoying during the fall of 1947 than they had been since the early forties. They were not observed to have been unusually plentiful during the summer but they congregated about the south sides of many homes during the fall, causing more complaints than usual.

**Buffalo** and **varied** carpet beetles were exceptionally numerous at windows in Riley County on April 24, just as spiraea was coming into bloom. These insects appeared about three weeks late but they were more plentiful than in recent years.

**Cabbage** worms were about equal in numbers to the two previous years, questionnaire reports indicated. Somewhat fewer counties reported them, but there were more 3 and 4 scores than in 1946. The two species of cabbage worms caused most injury to late cabbage.

**Cankerworms** were approximately as numerous in 1947 as in 1946. They caused marked foliage injury only in Topeka and certain other localities in counties of the eastern half of the state. The moths were observed to be scarce at Manhattan and northeast Kansas during March and April. The peak of moth emergence did not occur in Manhattan until about April because of the cold, backward season. Elms did not produce seed until the latter part of April, and at no time were cankerworms observed to be more than occasional. No foliage damage was observed. They were reported on apple trees in Doniphan County. Observers reported about the usual amount of



damage to elms in the fields in the country in the southeastern one-fourth of the state.

**Cattle grub flies** were reported as having been much less numerous than in 1946. They were most abundant in the groups of counties in the four corners of the state. Most of the counties scored at 3 are in the western half of the state. No doubt, extension programs for the control of cattle grubs reduced the numbers somewhat, and made cattle producers more aware of these pests.

**Chinch bugs** were of small consequence in Kansas during 1947. They were scored below the two previous years and from fewer counties. They passed the winter in fair numbers, and a larger number than expected was observed in many thin stands of wheat in the Manhattan area. The cold, wet, backward spring, however, was unfavorable to them, and in most places in the state they did not attain threatening numbers. Control practices were applied in only a few localities and only slight damage was done. Chinch bugs were reported on sorghums in Neosho, Republic, Ellsworth, Barton, and Gray counties; on corn in Woodson and Cowley counties; and on wheat in Russell and Ness counties. The fall chinch bug survey revealed the smallest number of chinch bugs in hibernation since 1924.

**Cicadas** were more numerous in Kansas during 1947 than since 1930, when brood 15 of the seventeen-year species had previously occurred. However, both this and the ordinary two-year species were especially plentiful and were the cause of many newspaper articles and other comment. The seventeen-year cicada began to appear in wooded areas in early June and their distinctive noise continued throughout most of July. This species occurred in large numbers only in scattered woodlands in eastern Kansas, but they were observed also laying eggs and resting in numbers in some orchards, nurseries, and young groves. The total damage done by oviposition was probably slight. The brood is believed to have been larger and more numerous than in 1930.

The common cicada (*Tibicen pruinosa*) occurred throughout the eastern half of the state and the "singing" was so intense and general during the summer as to cause annoyance to many persons.

**Clover seed chalcids** were observed as plentiful during 1947, and alfalfa seed was more severely damaged by this species than usual. There was also more correspondence regarding this species, which some correspondents called "weevil," than usual.

**Clover stem borer** (*Languria mozardi*) was unusually plentiful this year in the eastern third of the state where it attacked alfalfa, sweet clover, and crimson clover. Many specimens were sent in for identification. It was reported at a meeting of beekeepers in northeast Kansas in mid-July that this insect had been so numerous that it caused cessation of nectar production in affected plants. This is the first time for many years that this insect has been numerous.

**Codling moths** in unsprayed orchards were approximately equal to 1946 and normal in numbers, but where orchards were properly sprayed, and particularly where DDT was incorporated in some of the cover sprays,

codling moths were less of a factor than usual. Elbert Eshbaugh, Wathena, Kansas, reported the first codling moths taken in emergence cages on May 21. This was about a month later than in 1946. Large catches of codling moths were taken in bait traps during the first ten days of June, and the second generation moths began to emerge on July 11. The development of the second brood was more rapid because of the hot, dry weather. A partial third brood began to develop August 23. The first cover spray was applied June 3.

Codling moth control in the properly sprayed orchards was the best ever obtained. A fairly large number of larvae from the third brood formed nests under the bark or in protected places so that something near the normal spring population can be expected.

Colorado potato beetles were not much more numerous than in 1946, although the species seems to be increasing slightly in numbers. Many gardeners applied insecticides to their potato crop largely as precautionary measures because individual plants throughout the state were heavily infested with them. It is doubtful whether commercial growers found it necessary to apply insecticides.

Corn earworms attained large numbers during 1947 and were judged to be somewhat more numerous and destructive than in 1946. Sweet corn was attacked severely by the second generation but, in general the first and second generations were probably no more abundant than usual. The third generation was more abundant and destructive than usual on late corn, sorghum heads, and soybeans. Corn, in general, was planted late because of the cold, wet spring. The third generation, therefore, had more soft corn available for food. The damage to field corn throughout the state was, in general, severe. More reports of damage to sorghum heads in central and western Kansas were received than for a half dozen years. The species was likewise extremely plentiful in alfalfa, but probably no more so than usual. The large third generation gave rise to great numbers of moths. R. H. Painter reported an exceptionally heavy flight about lights at a football game the latter part of October. Practically all of the moths seen were of this species and they rested on the walls of buildings at the rate of three or four to the square foot.

Corn root worms were plentiful in the main corn growing counties along the northern border of Kansas in 1947. Fallen corn in these counties showed the root system markedly reduced. While the southern and western species were the common ones present, there was evidence that another species was involved. H. R. Bryson and D. A. Wilbur stated that the species might be the so-called New Mexican corn root worm, judging by the several adults from Smith and Phillips Counties brought in and from the type of silk injury by the beetles.

Corn sap beetles (*Carpophilus dimidiatus*) were extremely abundant in the ears of early sweet corn in Riley County at mid-July. This species has not been observed in such large numbers in recent years.

**Crickets** had about the same population as last year. They caused about the normal number of inquiries because of entering homes, especially basements, during the hot, dry portion of the summer. They were reported from all parts of the state.

**Tree crickets** were somewhat more numerous than usual during August. They were observed more numerous than ever before when seen in flight in this community on the evening of August 9. Egg scars on stems of plants appeared to be somewhat more numerous than usual in the fall.

**Cucumber beetles** were reported from nearly every county, and were comparable in numbers and damage to 1946. They were reported on melons in Neosho, Nemaha, Smith, and Scott counties.

**Cutworms** were more numerous and destructive in the spring of 1947 than in 1946. They were observed as plentiful in gardens during the latter part of April, and about the normal number of letters of inquiry were received concerning damage to alfalfa and corn. The cold, wet spring was favorable for them, and corn in some fields in the eastern half of Kansas was severely attacked. Cutworms were reported in **gardens** in Doniphan, Wyandotte, Neosho, Greenwood, Cowley, Comanche, Ellis, Osborne, Smith, Norton, Thomas, Greeley, Gray, and Morton counties; as attacking **corn** in Nemaha, Washington, Clay, Harvey, Greenwood, Neosho, Phillips, and Cheyenne counties; in **wheat** in Leavenworth, Cowley, Smith, and Finney counties; in **barley** in Harvey and Reno counties; in **rye** in Labette; in **oats** in Graham; and in **alfalfa** in Rawlins and Reno counties.

**Elm calligrapha beetles** were less numerous and destructive in 1947 than in 1946. The populations and damage were largely confined to individual trees in various towns in central and south-central Kansas. It is believed that many trees were sprayed, either as a control for an infestation causing damage, or as a precautionary step in many of the cities in this area.

**Elm seed wing midges.** There was a large elm seed crop, but the midge larvae were neither seen nor reported.

The **European corn borer** was collected by LaVere Calkins and R. G. Yapp in the following 12 counties in Kansas in 1947: Atchison, Coffey, Doniphan, Douglas, Jefferson, Johnson, Leavenworth, Linn, Miami, Osage, Shawnee, and Wyandotte. The major survey was made during June to discover the stalks damaged by the first generation larvae. A brief survey during the latter part of August and early September revealed no second brood larvae. Most of the infested corn was sweet corn being grown in gardens in the towns. This is the largest number of counties ever found to be infested by this species in one year. It is also the first time that the borer has been taken as far west as Shawnee and Coffey counties.

**European elm scale** was discovered on elms in several additional towns of northwest Kansas not known previously to have this pest. They included, particularly, Colby and Sharon Springs. The previously reported infestation in St. Francis was surveyed by R. G. Yapp and found to be extensive. Vigorous spraying with miscible oil in March and DDT in June apparently reduced the infestation there. This was the first year that summer control

consisting of spraying infested trees with DDT to destroy the crawling young was practiced, and excellent results were obtained.

**Fall armyworms** were more numerous during the late summer and fall of 1947 than in 1946. They were reported attacking alfalfa in Crawford and Labette counties and corn, rye, and wheat in Franklin County.

**Fall webworms** were slightly more plentiful during the late summer of 1947 than in 1946, and were reported more widely in western Kansas than usual. The distinctive webs were observed to be fairly numerous in the eastern third of the state during the latter part of August. The reporters for Nemaha, Osage, Douglas, Coffey, Crawford, Labette, and Montgomery counties reported fall webworms on alfalfa, indicating that this insect was confused with the garden webworm. Perhaps the scores of 3 and 4 recorded for this species in Table III represent a similar mistake.

**False wireworms** were slightly more plentiful than in 1946, and were widely reported throughout the western third of Kansas during September and October. The abnormally dry fall was ideal for maximum injury by these insects which destroyed sown wheat when germination was delayed by drouth. Many farmers did not sow their wheat until late October and during November, partly to avoid loss by these insects. They were reported specifically in wheat fields in Mitchell, Russell, Ellis, Finney, and Haskell Counties. *Eleodes opaca* occurred widely in the western third of the state and *Eleodes suturalis* was apparently widely distributed in central Kansas.

**Fleas** in homes and on pets, while reported all over the state, were probably slightly below 1946 and were average for the state. They occurred particularly during the hot summer, possibly as the result of pets being allowed the run of basements to escape the heat.

**Flies** on livestock, other than horse flies, while reported at 2 to 4 for nearly every county, were considerably less numerous and annoying than in 1946 or for a number of years. Horn flies, stable flies, and house flies were rather slow to reach noticeable numbers in the spring, but stable flies attained fair numbers by June 15. The absence of flies around homes and restaurants, largely if not wholly due to the use of DDT, was a subject of conversation and newspaper comment during the season. The widespread spraying of cattle and barns was likewise responsible for the small number of horn flies on cattle and stable flies around barns. There were 426 power sprayers used in Kansas for treating cattle for horn flies and 11,869 hand sprayers used for treating barns, houses, and cattle. There were 68,992 farmers treating 1,939,360 head of cattle and 27,456 barns for stable and house flies. The reporters in many counties scored flies on cattle at 4 or 5 where the cattle were not sprayed with DDT, but 1 or 2 where they were sprayed.

**Screw worm flies** were fairly common all season, but there were no peaks or outbreaks observed or reported. It is thought that they were less numerous and less destructive than in 1946 or for several years. They occurred particularly in areas around the city stockyards and the rest yards for cattle at El Dorado, Yates Center, and Dodge City.

**Horse flies**, especially *Tabanus sulcifrons*, began to annoy livestock in southeast Kansas about the middle of July. R. L. Parker observed them

resting in that area on the highway and on automobiles. By the latter part of July, they constituted a major livestock problem in central Kansas and continued as such until near the end of August. They were more frequent than ever observed on the cool and shady sides of homes far from livestock. Horse flies were mentioned in reports from Atchison, Lyon, and Butler counties.

There were many efforts to protect domestic animals with various sprays, but a combination of DDT and BHC gave fair results. This outbreak prompted a vigorous correspondence and frequent articles in the press. It is not known why these insects attained such large numbers. The hot, dry season caused most of the streams and ponds to be low and many to go dry.

Garden webworms occurred in the severest and the most wide-spread outbreak which has occurred in the state of Kansas in 25 years. The outbreak could have been predicted from the large number of moths which were seen and reported throughout June in the eastern half of the state. The first generation was of no consequence since it was confined to weeds, especially nitweeds. Dahlies were attacked, and in some cases the foliage was severely webbed and eaten by this generation. The second generation which developed the latter part of June and in early July was widespread and serious. Corn, alfalfa, soybeans, cowpeas, and small grains were severely attacked. The injury to corn was more severe than was seen or reported in this state for many years. Many farmers sprayed or dusted their corn with a combination of DDT and benzene hexachloride with fairly good results reported. Others employed airplane companies to dust their fields to control garden webworms. This is the first time in the history of the state that airplanes were used commercially to control corn and alfalfa insects. The larvae occurred in fields over a period of two to three weeks. In some fields of alfalfa being left for seed, the buds and blossoms were severely damaged, reducing seed yield prospects materially.

Ordinarily, the third generation of garden webworm is of no consequence, but during August the third generation was fully as numerous and serious as the second. The drouth and hot weather made crop growing conditions difficult, so when attacked suddenly by a large third generation of webworms some fields were virtually ruined. Both the fact that the third generation did widespread, serious damage, and that it was of such short, intense duration were new and unusual features of the behavior of this insect in 1947. It was stated that 85 per cent of the alfalfa fields in the Kansas and Blue Valleys were damaged by the third generation of this insect. The dehydrating plants in the Kansas Valley closed temporarily because the crop was unsuitable for processing. Most reports of abundance and damage came from the eastern half of the state. So far as known, this insect was somewhat less plentiful in the western half of the state than usual.

Garden webworms were reported in alfalfa fields in Doniphan, Wyandotte, Franklin, Neosho, Labette, Montgomery, Dickinson, Clay, Riley, Cloud, Ellsworth, Pawnee, Gray, Finney, and Graham counties.

**Gnats** (mostly midges) became so numerous around lights in Riley County at mid-August that they entered homes through the screens and became a household annoyance.

**Grasshoppers** were about equal to 1945 but below 1946 in numbers. They were not particularly abundant nor destructive in Kansas during 1947. They were of economic importance only in some 21 western counties during the fall and in small isolated patches in many areas in the state. The impression prevailed that grasshoppers increased slightly in 1947 over the previous year.

Fred D. Butcher stated on May 28 that about 50 per cent of the grasshopper eggs were still unhatched and that about 20 per cent of the nymphs were in the third instar. This is explained by the fact that the season was several weeks late. By July 1 John S. Riss of the Bur. of Ent. and P. Q., determined that there would be a large, late hatch in the Elkhart District which might cause serious damage to late young corn, milo, and fall planted wheat. In eastern Kansas, by this time, the nymphs of the migratory species were generally one-third to one-fourth grown, and some damage was observed in flower and vegetable gardens. Mr. Butcher reported some grasshopper flights in the Garden City area on July 11 and 12. It was a light flight since only about 22 per cent of the grasshopper population there were adults. The distribution was observed to be very uneven, ranging from three to the square yard in fields, to one hundred at the edges of fields. About 15 per cent of the early nymphs died because of inclement weather. About ten per cent were affected by fungus disease in some areas. Egg deposition by the first generation of adults was general and spread over a long period of time. Practically all eggs deposited before August hatched so that the eggs laid in September wintered. In mid-August, grasshoppers were observed to be plentiful in small areas in the northeastern quarter of the state. They attacked especially corn, rhubarb, iris, and some ornamental plants. News items recorded their damaging the blossoms of alfalfa and red clover being left for seed.

Grasshoppers were reported in **alfalfa** in Wyandotte, Leavenworth, Douglas, Shawnee, Osage, Lyon, Neosho, Crawford, Labette, Chautauqua, Kingman, Harper, Russell, Pawnee, Norton, and Sherman counties; in **wheat** in Douglas and Norton counties; in **corn** in Woodson and Osage counties; in **gardens** in Smith and Kingman counties; and in **pastures** in Wabunsee County.

By the latter part of September, approximately 25,000 square miles of roadside were treated with poison bran mash for grasshopper control in western Kansas. This area included counties west of Decatur, south across Sheridan, Gove, Scott, Finney, Haskell, and Seward, west to the Colorado line. The migratory grasshopper was the dominant species. Most of the bait was made with sodium fluosilicate, but chlordan was used for the first time with satisfactory results. However, the cost of using chlordan was thought to be high. The only damage in western Kansas was to the foliage of corn along the field borders.

**Hackberry psyllid** adults of at least three species were observed numerous during the spring, after the buds were bursting, but they were less numerous during the fall than in 1946. The number of nipple galls was as large as in previous years. The adults were reported in numbers in homes during September by only one correspondent.

**Hessian fly** was less plentiful in Kansas than in 1946. This pest might have occurred in a great state-wide outbreak in 1947 if Pawnee wheat, which is resistant to hessian fly, had not been so generally planted in the western half of the state. This insect was not especially abundant anywhere in the state in the spring, except in individual fields in a few widespread localities. Heavy infestations of the fly up to mid-April were reported by E. T. Jones as "rare and spotted."

The U.S.D.A. hessian fly survey of the 1947 wheat crop revealed the following stem infestation in the different parts of Kansas:

Areas	No of counties	No fields sampled	Stems infested	
			Average Percent	Percent Maximum
Northwest	12	79	5.8	68
Southwest	11	42	0.1	4
Northcentral	16	123	6.97	52
Southcentral	18	129	15.6	98
Northeast	15	111	6.9	86
Southeast	12	61	7.8	64

Weather conditions for growth of wheat were almost perfect. The Crop Reporting Service indicated the condition of wheat at from 90 to 101 in many areas in the state. Wheat grew so rapidly that the small hessian fly population generally distributed made little or no appreciable difference. R. H. Painter reported there was less than usual reduction in the stands of wheat from hessian fly, weather, or other causes since November of the previous year, which was "very unusual." By the last of May, Louis Reitz and E. T. Jones found fields with considerable hessian fly near Kingman and some near Wichita. They reported hessian fly more commonly present than was generally thought by the vigorous growth of wheat which was then heading, and the hessian fly largely were little or no hindrance to the plants. In early June, R. H. Painter reported rather heavy infestation in the northern halves of Barton, Rice, and Marion counties in certain fields. Some damage to Pawnee and Kawvale wheats was observed north of Marion near the eastern edge of the county. The severest injury was observed in a field of the variety Red Chief. A field in the northern part of Rice County showed 75 per cent infestation of Tenmarq volunteer wheat in a field of Pawnee, which showed 16 percent stems infested.

One of the greatest wheat crops ever grown in the state was harvested. The perfect growing conditions for wheat completely overshadowed the presence of hessian fly.

Reports were received in early June from several northwestern counties, especially Decatur County, that the wheat in many fields was not heading or filling properly. Hurley Fellows and E. T. Jones determined that the cause was a combination of hessian fly and green bug injury earlier. While it is believed that the larger part of the damage was probably caused by green bugs, the infestation of wheat by hessian fly was determined as follows:

County	Percent of Infestation
Cheyenne	6 to 16 percent
Sherman	6 to 63 percent
Thomas	10 percent in the volunteer
Decatur	28 percent
Norton	16 percent

The hot, dry, late summer weather was unfavorable for hessian fly and there was little hessian fly found in wheat, except in the southeastern one-fourth of the state. Most of the adults emerged after the safe planting date in the central part of the state and relatively little damage was done. Most of the adults will come out next spring over much of central Kansas, according to R. H. Painter. Near Manhattan, flaxseeds developed in wheat which was planted as late as October 11, and larvae were found on wheat planted on October 14.

**Imported currant worms** defoliated gooseberry and currants in the eastern third of Kansas during the latter part of April and early May. They were about as numerous as in 1946.

**Leafhoppers** had larger populations in 1947 than in 1946. Certain species were especially numerous and destructive to alfalfa and grapes in Kansas during 1947. The damage was augmented by the hot, dry, unfavorable growing weather during the summer. Leafhoppers were reported on **potatoes** in Doniphan, Miami, Shawnee, Neosho, and Cloud counties; on **grapes** in Riley, Doniphan, and Wyandotte counties; and in **gardens** in Woodson and McPherson counties.

**Maize billbugs** were seen and reported as exceptionally abundant during June in some cornfields along the river in Riley and Pottawatomie counties. This species seemed to be somewhat more plentiful than in 1946 in fields which previously had been flooded and where corn had been grown continuously for many years.

**Mosquitoes** were plentiful and annoying following the heavy rains of May and early June, but during the rest of the year were scarce. Most small streams and pools evaporated during August and September. Mosquitoes were reported annoying to cattle in Neosho and Reno counties.

**Polistes wasps** were observed as plentiful and annoying around buildings during October.

**Pentatomids** were reported in flight at Lyons on October 20. They swarmed about the lights and store windows in sufficient numbers to result in newspaper accounts.

**Redbanded leafroller, *Fascista cercerisella* (Cham.)**, had three generations at Manhattan, each larger than the preceding. This species was more



abundant in 1947 than for several years. The last generation did severe damage to the foliage in September.

**Iris borers** were again very numerous on the grounds of St. Benedicts College in spite of an eradication program to eliminate them. They were neither seen nor reported in any other part of the state.

**Mites** of various species had smaller populations during 1947 than in 1946. The hot, dry, summer after mid-July was favorable for them and the **two-spotted mite** reached outbreak proportions in apple orchards in north-east Kansas during September. This occurrence was most marked in orchards in which DDT was used for spraying. They were scarce during June and July everywhere in the state.

**Chigger mites** were less numerous and annoying than in 1946 during July and August in all parts of the state. They continued to be annoying in Riley County until early September.

The **European red mite** was reported from Doniphan County, but it was not authoritatively identified. The name is frequently attached to any red mites found in the state; but so far as is known, the European red mite does not occur in the state. The Pacific mite, which has been taken in the state and is also red, may be confused readily with the European red mite.

Many **arbor vitae** appeared to show mite damage, but in most cases injuries were caused by the freezing weather of January, which injury was more severe than has been noted for a generation or more.

**Rose sawflies** or rose slugs caused more injury in the eastern third of the state during May than has been noted for many years. Rose bushes with the foliage completely ruined were observed frequently in Riley, Clay, and Doniphan counties.

**Stored grain insects** attained the largest numbers during 1947 observed for many years, because so much of the crop was stored in anticipation of higher prices.

R. T. Cotton reported a large increase of stored grain insects in the wheat bins, granaries, and elevators. His statement follows:

"Insect infestation in farm-stored wheat in Kansas has been particularly high during 1947, probably due to the fact that the moisture content of grain in storage was higher than normal and favored the more rapid increases of insect populations.

"Observations made by H. H. Walkden in two counties in south-central Kansas showed that the average insect population in untreated wheat in farm storage increased from 40 insects per quart sample in July to 108 per quart of wheat in September.

"If all wheat in farm storage in Kansas in September was equally infested it would mean a population of some 385 billion insects in farm bins."

**Scale insects** in general appeared to have increased and were more numerous than in recent years. **Forbes scale** was found in the largest numbers ever seen in the state in the region of Troy in certain orchards where DDT had been used to control codling moth for two years. This scale is held ordinarily in check by parasites. It therefore is believed that the DDT killed the parasites but not the scale. The small scale, which resembles San Jose

scale closely, was discovered by R. G. Yapp heavily clustered on twigs and around the blossom end of fruit. (See also European elm scale.)

**Squash bugs** were approximately equal in numbers to 1946 but little more information is at hand than is given in Table III.

**Stalk borers (*Papaipema*)** were more abundant this year than for several years.

**Strawberry root worms** caused severe injury to the foliage of strawberries in northeast Kansas during April and May. The injury was particularly severe in Doniphan County.

**Southwestern corn borer** increased in numbers during 1947 particularly in the central area of the infested portion of the state. D. A. Wilbur observed in October that fully 70 percent of all the infested stalks had been girdled and were down.

H. H. Walkden, in the fall survey, reported that "the eastern line of infestation in both Oklahoma and Kansas was found to be practically the same as in 1946. In Kansas, no infestation could be located in the fall of 1947 in certain of the counties along the eastern border of infestation in which borers were found last year, which is a line through Greenwood, Coffey, and Riley counties. The most heavily infested areas surveyed continue to be the sandy soil region of Earton, Edwards, Stafford, Rice, Reno, Pratt, and Barber counties in southcentral Kansas. Eastward from these areas, the infestation decreased rapidly. From 1940 to 1945, the corn acreage in the seven counties mentioned decreased from 100,000 to 54,000 or 46 percent. There was a still further reduction in 1947."

**Tarnished plant bugs** were observed to be extremely abundant in alfalfa during July and August. The **rapid plant bug** was also especially numerous and the **alfalfa plant bug** was taken in larger numbers than ever before in the history of the state. In certain fields, this species averaged one adult or nymph to each sweep of the insect net.

**Termite swarms** were late in appearing because of the cold, late spring but a few swarms appeared during April. During the year, termites were probably less numerous and destructive than in 1946.

**Walnut worms** were observed in small numbers about mid-July in Riley County. The second generation in August and September also did slight damage to a few trees. They were scarce in 1946 but slightly more plentiful in 1947.

**Wheat stem maggots** were more abundant in both the crop harvested in June and in the fall wheat than in 1946. Some of the hessian fly reports from the western half of the state are believed to be based on wheat stem maggot infestation.

**Wheat straw worms** were reported about equal to 1946 populations, but more counties included them in their reports in 1947.

**White grubs** were more abundant and destructive during 1947 than in 1946. The grubs were observed to be exceptionally plentiful in gardens and lawns in Riley County during April and early May. The adults appeared about May 1 and were more numerous around lights than for several years. Their flying against screens of lighted homes from May to July was a fea-

ture of the year. The foliage of many plants was damaged by the feeding of the adults, and considerable of the grass injury during early summer is believed to have been caused by the grubs. Several species were involved in the large flights.

**Cyclocephala grubs** continued abundant in the western half of Kansas and caused damage to some 50,000 acres of fall sown wheat in central and northwest counties. Growers, however, delayed sowing of their wheat because of inadequate moisture; otherwise the damage from this species might have been extensive. The increase in this species is believed to be due to plowing under so much wheat straw.

**Wireworms** were more plentiful in 1947 than in 1946 and were reported from more counties also.

## SUMMARY AND CONCLUSIONS

Corn and other spring seeded crops had a late start on account of the cool, wet weather during the spring and were badly damaged in a severe drouth and hot spell that began the latter part of July and continued through September. August was the hottest in 10 years and the driest in 11 years. Record-breaking or near record-breaking hot weather continued through September, with rainfall deficient. Pastures dried up and corn suffered further damage. October was the warmest on record and below normal in precipitation, which resulted in an unfavorable condition for seeding wheat. November, however, was cool and cloudy, with frequent light rains, and December falls of moisture totaled heavier than any since June.

The wheat crop was one of the largest ever harvested in the state. The largest acreage was devoted to wheat and the highest average bushel yield per acre was harvested. The oats, barley, alfalfa and other hay, alfalfa seed, and apple crops were well above the ten year averages. Corn, potatoes, sorghums, soybeans, and honey production was well below that of the recent several years.

It was a year of increased populations of many species of insects and of some outbreaks. The following insects and related forms occurred in **outbreak** numbers or were as numerous as they have been in previous years of high abundance: armyworms, including the wheat head armyworm locally in eastern Kansas; cicadas, both the seventeen-year and two-year species in eastern Kansas; false wireworms in western Kansas; horse flies; garden webworms; maize billbug; stored grain insects in wheat; and the cyclocephala white grub in west-central Kansas.

The following species in addition to those listed under outbreak were **more numerous** in 1947 than in 1946: pea aphids, green bug, black flies, borers in shade and fruit trees, boxelder bugs, carpet beetles, clover seed chalcid, clover stem borer, Colorado potato beetle, corn earworms, corn rootworms, corn sap beetles, European cornborer, tree crickets, cutworms, fall armyworms, fall webworms, leafhoppers, mosquitoes (early summer),

polistes wasps, red-banded leafroller, rose sawfly, scale insects especially Forbes scale, southwestern cornborer, tomato hornworms, plant bugs, walnut worms, wheat stem maggots, and white grubs.

The following species were as plentiful in 1947 as in 1946: ants, blister beetles, cankerworms, codling moths, columbine leaf miner, crickets, cucumber beetles, cutworms, mites—two-spotted and chigger mites in northeast Kansas, squash bugs, tent caterpillars, and wheat strawworms.

The following species were less plentiful in 1947 than in 1946: aphids on apple, snowball, chrysanthemum, and spiraea; bagworms, bot flies, bean leaf beetles, cabbage worms, cattle grubs, elm Calligrapha, fleas in homes; flies including horn, stable, house, and screwworm flies, grasshoppers, hackberry psyllids, hessian fly (except southcentral Kansas), mosquitoes (late summer and fall), mites, termites, tomato hornworms, and millipedes.

The following species were scarce or had extremely low populations in 1947: elm seed wing midge, chinch bugs, and green striped maple worms.

### NOTE ON EMBIOPTERA IN KANSAS

During the present winter, Robert Kitchen, a student in General Entomology at Fort Hays Kansas State College, has collected three winged Embiids in his basement apartment in Hays, Kansas. The three collection dates were, December 13, December 17, and January 17, and all specimens were found on the floor or walls of the apartment. The colony has not been found but crevices in the concrete floor near the furnace offer the best possibility for breeding places.

A specimen was sent to Doctor Edward S. Ross, Curator of Insects at the California Academy of Sciences, who identified it as *Oligotoma saundersii* (Westwood). This species is apparently distributed throughout the warmer regions of the world.

Prior to March, 1944, a dealer in oil well supplies owned the house and made frequent business trips by plane to Texas. From March, 1944, to August, 1945, the families of three airplane pilots lived in the apartment at various times and brought various items from points in Texas, Florida, Cuba, Mexico, and Panama. So far as known, there is no way by which the insects could have been introduced into the apartment since August, 1945, as occupants since that time have not made trips to the southern part of the United States or other places where these insects are normally found.

LEON HEFNER,  
Hays, Kansas.

## HOMONYMY NOTES IN THE BIBIONIDAE

D. ELMO HARDY

Ames, Iowa

While preparing a check list of the world Bibionidae, the writer has found that quite a number of the names now in use are preoccupied and need to be changed.

**Penthtria brunettii**, new name for **Penthtria atra** (Brunetti), 1911, Rec. Ind. Mus., 4:272. Preoccupied by **Penthtria atra** Macquart, 1834, Hist. Nat. Ins., 1:175. Brunetti's *atra* was described in the genus **Precia** but it is a typical **Penthtria** and has been changed to this genus.

**Plecia malayaensis**, new name for **Plecia minor** Edwards, 1928, Journ. Fed. Mal. States Mus., 14:44. Preoccupied by **Plecia minor** Jaennicks, 1867, Abhandl. Senckenb. naturf. Gesellsch., 4:318.

**Plecia mallochi**, new name for **Plecia confusa** Malloch, 1928, Proc. Linn. Soc. New S. Wales, 53:605. Preoccupied by **Plecia confusa** Loew, 1858, Berl. Ento. Zeits., 2:109.

**Philia beckeri**, new name for **Philia minor** (Becker), (**Dilophus**), 1908, Mitt. Zool. Mus. Berl., 4:60. Preoccupied by **Philia minor** (Strobl), (**Dilophus**), 1900, Wien. Ent. Zeitg., 19:92.

**Philia edwardsi**, new name for **Philia minor** (Edwards), (**Dilophus**), 1938, Ann. Mag. Nat. His. (11)2:330. Preoccupied by **Philia minor** (Strobl).

**Philia brazilensis**, new name for **Philia occipitalis** (Edwards), (**Dilophus**), 1935, Stylops, 4:21. Preoccupied by **Philia occipitalis** (Coquillett), 1904, Invert. Pac., 1:20.

**Philia peruensis**, new name for **Philia clavipes** (Edwards), (**Dilophus**), 1935, Stylops, 4:24. Preoccupied by **Philia clavipes** (Lundström), (**Dilophus**). This was apparently just a cabinet name of Lundström's in the Hungarian National Museum. Duda published it as a synonym of **P. l'ingens** (Loew) in 1930, Die Flieg. der Pal. Reg., 2(4):33.

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# *Journal of the Kansas Entomological Society*

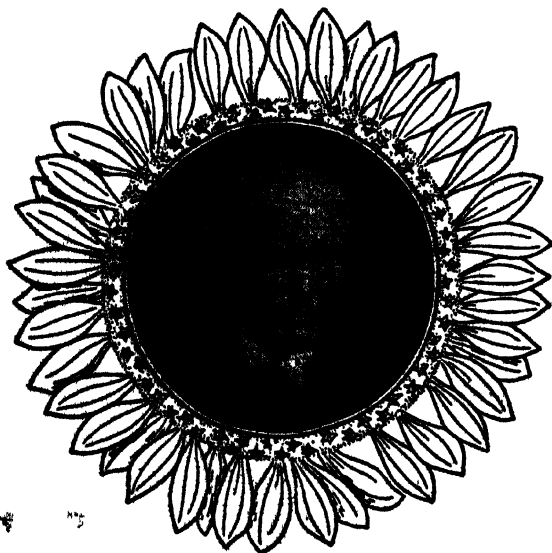
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**Vol. 21, No. 2, April, 1948**

*This issue mailed May 20, 1948*

**NEW SPECIES OF ENITHARES**  
**(Hemiptera, Notonectidae)**

GEORGE T. BROOKS

While preparing a forthcoming monograph of the genus *Enithares* Spinola under the direction of Dr. H. B. Hungerford, I discovered several species heretofore undescribed.

The color pattern for the species of this genus is highly variable, there being forms ranging from light to dark in the majority of species. Though in some instances only one color pattern is described, others may exist, as my color descriptions are based only on specimens at my disposal.

The first tarsal segment used throughout this paper in structural characterization is actually tarsal segments one plus two. The basal tarsal segment is very small and not always evident. Tarsal segment two is actually the third.

The specimens studied came from many different museums and these museums will be indicated according to the following legend: Snow Entomological Collections—S. E. C., United States National Museum—U. S. N. M., Paris Museum—P. M., Harvard Museum of Comparative Zoology—H. M., Carnegie Museum—C. M., Naturhistorisches Museum at Basel, Switzerland—B. M., Indian Museum at Calcutta, India—I. M., and the British Museum—Br. M.

The new species are described below.

***Enithares stridulata* n. sp.**

Plate 1, figure 1

**Size:** Large robust species; length 11.4 mm. to 13.2 mm.; width of pronotum 4.5 mm. to 5.4 mm.

**Color:** Variable, light and dark forms. **Dark form:** eyes dark brown; vertex light brown; pronotum same color as vertex with a dark brown transverse band immediately behind the head, posterior margin appearing black as it is hyaline and overlies the black anterior margin of the scutellum; scutellum black, with or without a light brown triangular stripe on each side of the apical half; hemelytra dark brown or black with longitudinal hyaline bands extending for indefinite lengths from the base. **Light form:** eyes light brown or dark brown; vertex light brown; hemelytra light brown and faintly hyaline; clear zone of hemelytral membrane may be dark brown. Legs of both forms testaceous. Abdominal venter of both forms dark brown or testaceous; if the former, the keel and lateral margins are testaceous.

**Structural Characteristics:** As viewed from above the anterior margin of the head is almost straight with its antero-lateral corners rounded; head short and its width much narrower than that of the pronotum; vertex with

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\* Contribution from the Department of Entomology, University of Kansas.

its anterior width slightly more than its length; synthlipsis wide, more than one-half as wide as the anterior width of the vertex; along the median longitudinal axis the head is shorter than the pronotum. Pronotum more than three times as wide as its median length with its anterior lateral margins broadly rounded; posterior margin of pronotum concave; dorsal margin of pronotal fovea slanting laterally from behind the eyes. Nodal furrow may be slanting or curved forward and equal to or slightly more than its length removed from the membranal suture. Males with the apex of the clavus slightly raised and roughened by numerous pits. Mesotrochanter angulate. Metaxyphus with its basal lateral margins curved and converging; apical lateral margins almost straight and parallel; apex of metaxyphus truncate with the apical margin at right angles to the apical lateral margins. Anterior tibia of males with a slightly concave indentation on its anterior margin just below the middle. A row of small black transverse ridges extends along the apical posterior margin of the middle tibia and posterior margin of the tarsus of the males. Male genital capsule as shown on Plate I, figure 1. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	122	32	15
Male middle leg	100	81	40	17
Female front leg	100	109	37	20
Female middle leg	100	81	39	18

**Location of Types:** Holotype ♂, allotype ♀, 4 ♂ and 5 ♀ paratypes, Indo-China, Luang Prabang, Ban Sambang, November 20, 1918, R. V. de Salvaza, in the British Museum. One ♂ and 1 ♀ paratypes, same collector, place, and date, in the Snow Entomological Collections.

**Comparative Notes:** Similar to *E. lineatipes* Horvath but much larger. Males of *E. lineatipes* lack the raised claval apex and ridges of middle tibia and tarsus.

**Data on Distribution:** In addition to the type series.

#### Indo-China

Luang Prabang, Muong You, Nov. 13, 1917, R. V. de Salvaza; 1 ♀ (Br. M.)

Tonkin, Chapa, June 1916, R. V. de Salvaza; 1 ♀ (Br. M.)

Laos, Xieng Khouang, Dec. 23, 1918, R. V. de Salvaza; 2 ♂ ♂ (Br. M.)

Laos, Xieng Khouang, Ben Sai, March 1919, R. V. de Salvaza; 1 ♀ (Br. M.)

Luang Prabang, Sala Man Pik, Mar. 27, 1918, R. V. de Salvaza; 1 ♂ (Br. M.)

#### *Enithares metallica* n. sp.

Plate I, figure 2

**Size:** Length 10.2 mm. to 11.5 mm.; width of pronotum 3.9 mm. to 4.1 mm.

**Color:** Variable, light and dark forms. **Light form:** eyes grayish brown; vertex light brown; pronotum same color as vertex, may have a slightly darker transverse band immediately behind the eyes; scutellum light brown; hemelytra light brown with longitudinal hyaline areas extending from base

and these may appear darker due to the dark body surface underneath, clear zone of membrane dark brown; legs testaceous; ventral abdominal sclerites light brown with keel and lateral margins testaceous. **Dark form:** Eyes light brown or brown; vertex stramineous, anterior margin may be tinged with red; pronotum with anterior portion light gray, separated from white posterior portion by a line of dense punctations, posterior margin may be hyaline and if so, appears black as it overlies the black anterior margin of the scutellum; scutellum stramineous with anterior margin black; hemelytra dark brown, almost black with uneven longitudinal flavus stripes radiating from the base along the lateral margins and outer margins of clavus, lateral margins of hemelytra may be hyaline; legs testaceous, ventral abdominal sclerites dark brown with keel and lateral margins light brown.

**Structural Characteristics:** As viewed from above the head is short with the anterior outline rounded; vertex with its width greater than its length; synthlipsis wide, over one-half the anterior width of the vertex; along the median longitudinal axis the head is shorter than the pronotum. Pronotum with width more than three times its median length; posterior margin concave; dorsal margin of pronotal fovea directed laterally from behind the eyes. Nodal furrow curved forward or slanting forward and less than its length removed from the membranal suture. Metaxyphus with basal lateral margins slightly curved convexly and apical oblique lateral margins meeting in a short pointed apex. Male genital capsule as on Plate I, fig. 2. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	113	46	23
Male middle leg	100	84	33	17
Female front leg	100	108	44	24
Female middle leg	100	84	34	18

**Location of Types:** Holotype ♂, allotype ♀, and 1 ♂ paratype, Siam, 1924, Hugh Smith, in the United States National Museum; 1 ♂ and 1 ♀ paratypes, same place, collector, and date, in Snow Entomological Collections.

**Comparative Notes:** Although somewhat smaller than *E. templetoni* (Kirby), this species resembles it very closely. Both have short broad heads and their lateral body outlines converging from the posterior margins of the pronotum. These two species can be readily separated, however, as the metaxyphus of *E. metallica* has its basal lateral margins slightly curved convexly and these curve gradually into the apical oblique margins whereas in *E. templetoni* the basal lateral margins are raised and curved concavely; these bend abruptly into the apical oblique margins and the angle there formed is thickened and appears nodule-like.

**Data on Distribution:** In addition to the type series.

#### Malay Peninsula

Perak, 7 miles south Taiping, waterfall in still sandy pool, July 3, 1937, 1 ♂, 2 ♀ ♀ (Br. M.).

Teku River, 4500 ft., Dec. 13, 1921, 2 ♂♂, 1 ♀ (Br. M.).

Wraip Camp, 3300 ft., Dec. 10, 1921, 1 ♀ (Br. M.)

### Siam

Bulsit Besar, 2 ♀♀ (Br. M.).

### Indo China

Tonkin, Hoabinh, Jan. 1917, R. V. de Salvaza, 2 ♂♂, 2 ♀♀ (Br. M.).

### *Enithares bakeri* n. sp.

Plate I, figure 3

**Size:** Small robust species; length 7.8 mm. to 8.1 mm.; width of pronotum 2.7 mm.

**Color:** Eyes dark brown or brown; vertex and remainder of dorsal surface of body light brown; legs and abdominal venter testaceous; abdominal venter may be dark brown with keel and lateral margins testaceous.

**Structural Characteristics:** Head long and broad with its anterior margin rounded; vertex with its anterior width less than its length; synthipsis wide, at least one-half as wide as the anterior width of the vertex; along the median longitudinal axis the head is longer than the pronotum. Pronotum with its width more than three times its length; posterior margin of pronotum almost straight; pronotal fovea with its dorsal margin curving laterally from behind the eyes. Nodal furrow directed dorsad and more than its length removed from the membranous suture. Mesotrochanter angulate. Metaxyphus with basal lateral margins almost straight and parallel; apical oblique lateral margins straight and converging, meeting in a pointed apex. Male genital capsule as shown on Plate I, figure 3. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	101	43	16
Male middle leg	100	82	32	12
Female front leg	100	103	38	19
Female middle leg	100	82	33	22

**Location of Types:** Holotype ♂, allotype ♀, 3 ♂♂ and 5 ♀♀ paratypes, Surigao, Mindanao, Baker, in the United States National Museum; 1 ♂ and 1 ♀ paratypes, same place and collector, in the Snow Entomological Collections.

**Comparative Notes:** This species resembles *E. sinica* Stål in general body contours though somewhat smaller. The males of this species lack the femoral spur as found on the hind femur of *E. sinica*. Also in this species the head is distinctly longer than the pronotum whereas in *E. sinica* the head is shorter than the pronotum.

**Data on Distribution:** Known only from type series.

***Enithares malayensis* n. sp.**

Plate I, figure 4

**Size:** Length 9 mm. to 9.3 mm.; width of pronotum 3.3 mm. to 3.6 mm.**Color:** Eyes brown, vertex light brown; pronotum same color as vertex; scutellum dark brown with a lateral triangular dark brown patch on each side, meeting in the apex to form a "V". Hemelytra dark brown or black with hyaline areas that appear black due to the dark body surface underneath. Legs and abdominal venter testaceous, the latter may be unevenly colored dark brown.**Structural Characteristics:** As viewed from above the head is short with its anterior margin rounded; vertex with its anterior width greater than its length; synthlipsis wide, equal to one-half the anterior width of the vertex; along the median longitudinal axis the head is much shorter than the pronotum. Pronotum less than three times as wide as its median length; posterior margin concave; dorsal margin of pronotal fovea curving laterally from behind the eyes. Nodal furrow curved forward and less than its length removed from the membranous suture. Anterior tibia curved forward being concave on its anterior margin and convex on its posterior margin, also heavily haired along lower anterior margin. Middle tibia of males swollen to form a convex arch along the dorsal surface; expanded at its apex to form a short triangular eminence along the anterior basal fifth of the tarsus, this expansion also provided with a short ventrally directed spur at its base. Mesotrochanter forms a distinct spur at the inner ventral angle. Metaxyphus with basal lateral margins straight and converging, apical oblique margins straight and meeting in a point. Male genital capsule as on Plate I, figure 4. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	102	43	18
Male middle leg	100	98	67	21

**Location of Types:** Holotype ♂, Kedah Peak 2900 ft., Malay Peninsula, Dec. 2, 1915, in the British Museum; 1 ♂ paratype, same place and date, in the Snow Entomological Collections.**Comparative Notes:** This species strongly resembles *E. abbreviata* (Kirby) but can be quickly separated from the latter as the males have a mesotrochanteral spur which is lacking on *E. abbreviata*. The males of this species also lack the patch of small black spicules on the anterior surface of the mesotrochanter and the first tarsal segment of the middle leg is distinctly longer than the second whereas *E. abbreviata* has the above mentioned mesotrochanteral spicules and has the first tarsal segment much shorter than the second.**Data of Distribution:** Known only from type series.***Enithares hungerfordi* n. sp.**

Plate I, figure 5

**Size:** Length 13.2 mm. to 16.8 mm.; width of pronotum 5.4 mm. to 6mm.**Color:** Variable, light and dark forms. **Light form:** eyes grayish brown,

brown or dark brown; vertex stramineous; pronotum same color as vertex with posterior margin hyaline and appearing brown as it allows the brown color of the underlying portion of the scutellum to be seen; scutellum and hemelytra light brown or stramineous; the hemelytra may be partly or wholly hyaline. **Dark form:** eyes grayish brown; vertex light brown; pronotum immediately behind the eyes dark brown, followed by a transverse band the same color as the vertex, which may be hyaline on its posterior margin and appear black due to the underlying black portion of the scutellum; scutellum black with a lateral flavus stripe on each side; hemelytra black with basal half of corium and clavus irregularly colored with brown. Both forms have legs testaceous and ventral abdominal segments dark brown with keel and lateral margins light brown.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded; head short; vertex with its anterior width greater than its length; synthlipsis wide, more than one-half as wide as the anterior width of vertex; along the median longitudinal axis the head is shorter than pronotum. Pronotum at least three times as wide as long; posterior margin only slightly concave, almost straight; dorsal margin of pronotal fovea curving laterally from behind the eyes. Nodal furrow curved forward and less than its length removed from the membranal suture. Hind femur of males with a black nodule on lower posterior margin. Mesotrochanter angulate. Metaxyphus with basal lateral margins almost straight, only slightly curved; apical oblique lateral margins straight and meeting in a point. Male genital capsule as shown on Plate I, figure 5. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	110	38	14
Male middle leg	100	86	38	22
Female front leg	100	105	41	17
Female middle leg	100	84	40	24

**Location of Types:** Holotype ♂, allotype ♀, a small stream below Jumma Cottage, Kodaikanal, Palni Hills, S. India, October 7, 1925, S. L. Hora, in the Indian Museum at Calcutta; 1 ♂ and 1 ♀ paratypes, same place, collector, and date, in the Snow Entomological Collections.

**Comparative Notes:** Of the same shape and size as *E. triangularis* (Guérin-Meneville) and resembles it very closely. However, the males of *E. hungerfordi* have a more pronounced tubercle on the hind femur and it is located more on the ventral surface than the similar tubercle of *E. triangularis*. Also the males of the latter species possess a short triangular eminence on the ventral surface of the anterior femur. This eminence is lacking on the anterior femur of the males of *E. hungerfordi*.

**Data on Distribution:** In addition to the type series.

#### India

Kodaikanal, Palni Hills, S. India, S. Kemp, August 1922, 3 ♂♂, 6 ♀♀ (I.M.), 2 ♂♂, 6 ♀♀ (S.E.C.); T. V. Campbell, 1 ♂ (S.E.C.) 2 ♀♀ (Br. M.).

Kodaikanal, S. India 7000 ft., March 27, 1936, 1 ♂, 6 ♀♀ (Br. M.)

Pulvachi River, Palni Hills, S. India, S. Kemp, 1 ♀ (I.M.).

Inde Mere, Madura, Jos Dubreuil, 2 ♂♂, 1 ♀ (I.M.) 1 ♂, 2 ♀♀ (S.E.C.).

India or Shembaganur, exchange fr. Horvath 2 ♂♂ (S.E.C.)

Inde Mere, Trichinopoly, Jos Dubreuil, 2 ♀♀, 2 ♂♂ (U.S.N.M.).

Trichinopoly, S. India, A. L. Montn, 1 ♂ (U.S.N.M.)

Naraikkadu, 2500 to 3000 ft., Tinnevely Dt, S. India, March 9, 1936, 3 ♂♂, 5 ♀♀ (Br. M.).

***Enithares chinensis* n. sp.**

Plate II, figure 1

**Size:** Length 10.2 mm. to 10.8 mm.; width of pronotum 3.3 mm. to 4 mm.

**Color:** Variable, light and dark forms. **Light form:** entire dorsal surface testaceous with eyes brown. **Dark form:** eyes brown; vertex light brown; pronotum and hemelytra dark brown with the anterior lateral margins of the latter testaceous and faintly hyaline. Legs of both forms testaceous; ventral abdominal segments dark brown with keel and lateral margins testaceous.

**Structural Characteristics:** As viewed from above the head is broad with its anterior outline rounded; vertex with its anterior width greater than its length; synthlipsis wide, at least one-half the anterior width of the vertex; along the median longitudinal axis the head is slightly shorter than the pronotum. Pronotum at least three times as wide as its median length; posterior margin almost straight, only slightly concave; dorsal margin of the pronotal fovea curving laterally from behind the eyes. Nodal furrow straight and directed dorsad, more than its length removed from the membranal suture. Mesotrochanter rounded. Metaxyphus with basal lateral margins straight and almost parallel, apical oblique lateral margins curved concavely and meeting in a pointed apex. Male genital capsule as shown on Plate II, figure 6. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	107	37	18
Male middle leg	100	83	33	18
Female front leg	100	111	38	18
Female middle leg	100	91	32	17

**Location of Types:** Holotype ♂, Datchulan, China, 1939, T. H. Cheng, in the United States National Museum; allotype ♀ and 1 ♂ paratype, Foochow, China, Chenfu F. Wu, in the Imperial Museum in Japan.

**Comparative Notes:** This species is about the same size and shape as *E. lineatipes* Horvath. However, the anterior outline of the head is rounded whereas the anterior outline of the head of *E. lineatipes* is more or less straight with only the anterior lateral corners rounded. The first tarsal segment of the front leg of both sexes is twice the length of the second whereas in *E. lineatipes* this is not true.

**Data on Distribution:** Known only from type series.

**Size:** Length 9 mm. to 10.5 mm.; width of pronotum 3.6 mm. to 4.2 mm.



*Enithares buhleri* n. sp.

Plate II, figure 7

**Color:** Variable, light and dark forms. **Light form:** eyes brown; vertex pale brown; pronotum, scutellum and hemelytra the same color as the vertex, the hemelytra may have hyaline areas that appear darker due to the underlying dark body surface; frons with two brown spots, one on each side of the median line; legs testaceous; ventral abdominal segments light brown with keel and lateral margins testaceous. **Dark form:** eyes grayish brown; vertex stramineous; pronotum with its anterior portion dark brown, hind portion same color as vertex; posterior margin of pronotum may be hyaline and appear black as it overlies the black anterior margin of the scutellum; scutellum black, may have two lateral flavus stripes, one on each side of apical half; hemelytra black, may have its lateral margins and basal half light brown and hyaline; frons with the brown spots as found on the light forms; legs testaceous; abdominal venter brown or dark brown, with keel and lateral margins testaceous.

**Structural Characteristics:** As viewed from above the head is short with its anterior outline rounded; vertex with its anterior width greater than its length; synthlipsis wide, at least one-half as wide as the anterior width of the vertex; along the median longitudinal axis the head is slightly shorter than the pronotum. Pronotum slightly more than three times as wide as its median length; posterior margin concave; dorsal margin of the pronotal fovea curves laterally from behind the eyes. Nodal furrow curves forward and is less than its length removed from the membranous suture. Base of the labrum with its lateral margins thickened, appearing almost rectangular. Anterior tibia of male slightly concave along its anterior margin and prolonged into a very short triangular process at the base of the first tarsal segment. Middle tibia of males with similar more pronounced prolongation at its anterior apical margin. These processes are present on the front and middle tibiae of the females but very much reduced. First tarsal segment of the middle leg of the male roughly triangular in shape, the base being almost twice as wide as the apex. Mesotrochanter of males with its free periphery set with short black bristles; mesotrochanter angulate. Hind trochanter of males with a dark brown nodule at its base next to the base of the femur. Femur of both sexes with a depression on its anterior surface, near the base, deeper in the males than in the females. Small black nodule on the lower posterior margin of the hind femur of the males; lower posterior margin of hind femur of males provided with long hairs. Metaxyphus with lateral margins medianly concave, apical margin rounded. Male genital capsule as shown on Plate II, figure 7. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	104	37	23
Male middle leg	100	91	36	26
Female front leg	100	97	42	25
Female middle leg	100	84	37	26

**Location of Types:** Holotype ♂, allotype ♀, 1 ♂ and 1 ♀ paratypes, Soe, Timor, June 1935, C. Buhler and Meyer, in the Naturhistorisches Museum at Basel, Switzerland; other paratypes as follows: 1 ♂, Baaguia, Timor, Aug. 1935, C. Buhler and Meyer, in Naturhistorisches Museum at Basel, Switzerland; 1 ♂, Baaguia, Timor, August 1935, C. Buhler and Meyer; 2 ♀ ♀, Soe, Timor, June 1935, C. Buhler and Meyer; 1 ♂, Molle, Timor, 1935, Buhler, in the Snow Entomological Collections.

**Comparative Notes:** Although much larger than *E. gibbera* n. sp. the shape of the legs give it a close resemblance to this species. The triangular process on the anterior leg of the male of *E. gibbera* is longer than that of *E. buhleri* and the anterior margin of the first tarsal segment of the middle leg of the male is not convex as in *E. gibbera*, but straight. The apex of the metaxyphus of *E. buhleri* is rounded while that of *E. gibbera* is acuminate.

**Data on Distribution:** Known only from type series.

***Enithares loria* n. sp.**

Plate II, figure 8

**Size:** Length 6 mm. to 6.9 mm.; width of pronotum 2.4 mm.

**Color:** Eyes reddish brown or brown; vertex light brown; pronotum with its anterior half same color as vertex, posterior half hyaline and appearing brown due to the brown underlying portion of the scutellum; scutellum brown; hemelytra tan and partly or wholly hyaline; legs stramineous; abdominal venter dark brown with keel and lateral margins testaceous.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded, with its anterior width equal to its length; synthlipsis narrow, slightly less than one-half the anterior width of the vertex; along the median longitudinal axis the head is equal to or slightly longer than the pronotum. Pronotum at least three times as wide as its median length; posterior margin of pronotum straight or only slightly concave; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow directed more or less dorsad and less than its length removed from the membranous suture. When viewed ventrally the frons has two depressions, one on each side next to the eyes; immediately below these are two more medianly located depressions. Mesotrochanter angulate. Metaxyphus with its basal lateral margins convexly curved, apical oblique margins almost straight and meeting in a point. Male genital capsule as shown on Plate II, figure 8. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	100	37	16
Male middle leg	100	84	32	24
Female front leg	100	100	36	18
Female middle leg	100	83	36	19

**Location of Types:** Holotype ♂, allotype 1 ♀, 2 ♂ ♂ and 1 ♀ paratypes, New Guinea, Rigo, Luglio, 1889, L. Loria, in the United States National Mu-

seum; 1 ♂ and 1 ♀ paratypes, same place, collector and date, in the Snow Entomological Collections.

**Comparative Notes:** This species is about the same size as *E. mandalayensis* Distant and the light forms of the two species make them all the more similar. However, *E. lorlai* has a vertex with its anterior width equal to its length, whereas *E. mandalayensis* has the anterior width of the vertex less than the length. The latter species also has the outer (or posterior) claw of the middle leg of the male thickened and decidedly bent inward. This condition is lacking on the males of *E. lorlai*.

**Data on Distribution:** In addition to the type series.

Papua, Mafulu 4000 ft., December 1933, L. E. Cheeseman, 2 ♂♂ and 4 ♀♀ (Br. M.).

Australia, Adelaide River, 1 ♂ (Er. M.). J. J. Walker, 1 and 1 ♀ (Br. M.).

***Enithares fusca* n. sp.**

Plate II, figure 9

**Size:** Length 8.7 mm. to 9 mm.; width of pronotum 3.6 mm.

**Color:** Variable, light and dark forms. **Light forms:** eyes dark brown; vertex, pronotum, scutellum and hemelytra flavus; clear zone of the membrane dark brown; frons with two brown spots on anterior margin, one on each side of the median line and with a dark brown spot above the labrum; legs testaceous. **Dark form:** eyes dark brown; vertex light brown; anterior portion of pronotum dark brown, posterior portion stramineous with its hind margin hyaline and appearing black as it overlies the black anterior margin of the scutellum; scutellum dark brown or black with two lateral flavus bands, one on each side, hemelytra dark brown or black with faintly gray hyaline stripes extending from base along lateral margins of hemelytra and corium; frons with same brown areas as the light form; legs testaceous; abdominal venter dark brown with keel and lateral margins testaceous.

**Structural Characteristics:** As viewed from above the head is short with its anterior outline only slightly rounded; vertex with its anterior width greater than its length; synthlipsis wide, at least one-half as wide as anterior width of vertex; along the median longitudinal axis the head is shorter than the pronotum. Pronotum more than three times as wide as its median length; posterior margin concave; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow curved forward and less than its length removed from the membranous suture. Middle tibia of males with a black nodule on its inner surface at the apex. Hind femur of males with a small black nodule on the lower posterior margin. Mesotrochanter angulate. Metaxyphus with its basal lateral margins straight and converging; apical oblique lateral margins slightly concave and meeting in a pointed apex. Male genital capsule as shown on Plate II, figure 9. The relative lengths of the parts of the legs are as follows:

Male front leg	100	109	36	18
Male middle leg	100	92	30	18
Female front leg	100	104	36	18
Female middle leg	100	93	35	21

**Location of Types:** Holotype ♂, allotype ♀, 1 ♀ paratype, Parambikuiaim, Cochin State, India, Sept. 16-24, 1914, in the Indian Museum at Calcutta; 1 ♂ and 1 ♀ paratypes, same place, collector and date, in the Snow Entomological Collections.

**Comparative Notes:** Though closely resembling *E. intricata* Breddin, this species is slightly larger. It is strongly convex across the pronotum both longitudinally and transversely, a condition that is lacking in *E. intricata*. The males of the latter species lack the nodules as found on the middle tibiae and hind femora of the males of *E. fusca*.

**Data on Distribution:** Known only from type series.

***Enithares wallacei* n. sp.**

Plate II, figure 10

**Size:** Length 12.6 mm.; width of pronotum 4.2 mm.

**Color:** Eyes brown; vertex light brown; pronotum with anterior portion dark brown followed by a transverse stramineous band, posterior margin hyaline and appears dark brown or black due to the underlying dark margin of the scutellum; scutellum dark brown or black; hemelytra with basal half gray and hyaline and appears dark due to the dark body surface underneath, apical half dark brown; legs stramineous, ventral abdominal sclerites dark brown with keel and lateral margins stramineous.

**Structural Characteristics:** Head short and broad with its anterior outline rounded; vertex with its anterior width greater than its length; synthipsis wide, over one-half as wide as the anterior width of the vertex; along the median longitudinal axis the head is shorter than the pronotum. Pronotum with its width three times its median length; posterior margin concave; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow curved forward at its tip and less than its length removed from the membranous suture. Mesotibia of males slightly concave along its anterior surface just before the apex. Metaxyphus with basal lateral margins almost straight and parallel; apical oblique margin slightly concavely curved and meeting in a pointed apex. Male genital capsule as shown on Plate II, figure 10. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	110	37	20
Male middle leg	100	88	28	23

**Location of Type:** Holotype ♂, Mak, Celeb., Wallace, in the British Museum.

**Comparative Notes:** This species is about the same length as *E. triangularis* (Guérin-Meneville) and also resembles it very closely in coloration. However, the male of this species lacks the short triangular eminence as found on the ventral surface at the base of the femur of the male of *E. triangularis*.

**Data on Distribution:** Known only from type specimen.

**Enithares atra n. sp.**

Plate III, figure 11

**Size:** Length 9 mm.; width of pronotum 3.6 mm.

**Color:** Eyes yellowish brown; vertex flavus; anterior half of pronotum of the same color as vertex, posterior half gray with hind margin hyaline, appears black as it overlies the black anterior margin of the scutellum; scutellum black or may be cream colored with only the anterior margin black; hemelytra dark brown with lighter hyaline brown bands on corium and on the suture between the clavus and corium; legs stramineous; ventral abdominal sclerites dark brown, with keel and lateral margins light brown.

**Structural Characteristics:** As viewed from above the head is short with the anterior outline rounded; vertex with its anterior width equal to its length; synthlipsis wide, at least one-half as wide as the anterior width of vertex; along the median longitudinal axis the head is shorter than the pronotum at least three times as wide as its median length; posterior margin of pronotum concave; dorsal margin of pronotal fovea slants laterally from behind the eyes. Nodal furrow slanting forward and less than its length removed from the membranal suture. Mesotrochanter rounded. Metaxyphus with basal lateral margins concave and diverging; apical oblique lateral margins slightly concave and meeting in a pointed apex. Male genital capsule as shown on Plate III, figure 11. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	100	36	20
Male middle leg	100	87	31	22
Female front leg	100	104	36	23
Female middle leg	100	84	32	22

**Location of Types:** Holotype ♂, allotype ♀, 2 ♂♂ and 1 ♀ paratypes, New Guinea, Rigo, Luglio, 1889, L. Loria, in the United States National Museum; other paratypes as follows: 2 ♂♂ and 1 ♀, same place, collector, and date, in the Snow Entomological Collections; 5 ♀♀, same place, collector, and date, in the United States National Museum.

**Comparative Notes:** This species approximately the same size as *E. abbreviata* (Kirby) but its head is a little shorter and broader in relation to the pronotum than that of *E. abbreviata*. The males of this species lack the short flattened first tarsal segment of the middle leg and the area of black spicules on the inner surface of the mesotrochanter as found on the males of *E. abbreviata*. The dorsal margin of the pronotal fovea of *E. atra* curves laterally from behind the eyes while that of *E. abbreviata* is directed more or less posteriorly from behind the eyes before turning laterally.

**Data on Distribution:** Known only from type series.

**Enithares freyi n. sp.**

Plate III, figure 12

**Size:** Length 11 mm.; width of pronotum 4.2 mm.

**Color:** Eyes brown; vertex stramineous; pronotum same color as vertex, with transverse dark brown band immediately behind the eyes, posterior margin of pronotum hyaline, appears dark brown due to the dark brown portion of the underlying scutellum; scutellum dark brown with apex and apical half of lateral margins stramineous; hemelytra dark brown; legs stramineous; abdominal venter dark brown with keel and lateral margins stramineous.

**Structural Characteristics:** As viewed from above the head is short and broad with its anterior margin rounded; vertex with its anterior width greater than its length; synthlipsis wide, at least one-half the anterior width of the vertex; along the median longitudinal axis the head is slightly shorter than the pronotum. Pronotum more than three times as broad as its median length; posterior margin concave; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow slanting forward and less than its length removed from the membranal suture. Mesotrochanter rounded. Metaxyphus with basal lateral margins convexly curved and converging slightly; apical oblique lateral margins concavely curved and meeting in a pointed apex. Male genital capsule as shown on Plate III, figure 12. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	97	36	21
Male middle leg	100	87	33	22

**Location of Type:** Holotype ♂, Mt. Prov. P. I. Benguet, July 15, 1946, Dr. G. Frey, in the British Museum.

**Comparative Notes:** This species resembles *E. lineatipes* Horvath being about the same length and width. However, the head is more rounded on its anterior margin and is wider in relation to the width of the pronotum than that of *E. lineatipes*. The nodal furrow in *E. freyi* is less than its length removed from the membranal suture, whereas in *E. lineatipes* the nodal furrow is more than or at least equal to its length removed from the membranal suture.

**Data on Distribution:** Known only from type specimen.

***Enithares fruhstorferi* n. sp.**

Plate III, figure 13

**Size:** Length 10.2 mm.; width of pronotum 3.6 mm.

**Color:** Eyes brown; vertex light brown; pronotum with anterior half same color as vertex, followed by a darker band, posterior margin of pronotum hyaline and appears dark brown as it overlies the dark anterior portion of the scutellum; scutellum dark brown; hemelytra tan and hyaline; legs testaceous; ventral abdominal sclerites brown.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded; head broad; vertex with its anterior width greater than its length; synthlipsis wide, slightly more than one-half the anterior width of the vertex; along the median longitudinal axis the head is slightly shorter

than the pronotum. Pronotum three times as wide as its median length; posterior margin almost straight, only slightly concave; dorsal margin of pronotal fovea directed more or less caudad before turning laterally. Nodal furrow curved forward and less than its length removed from the membranous suture. Mesotrochanter angulate. Metaxyphus with basal lateral margins slightly convex; apical oblique lateral margins concave and meeting in a pointed apex. Male genital capsule as shown on Plate III, figure 13. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	117	46	22
Male middle leg	100	86	34	23

**Location of Type:** Holotype ♂, Tenegger-Gebrig, Java, H. Fruhstorfer, in the United States National Museum.

**Comparative Notes.** This species is about the same size as *E. abbreviata* (Kirby) and resembles the light forms of the latter. However, this male specimen lacks the area of black spicules as found on the mesotrochanter of the latter. The first tarsal segment of the middle leg is not shortened and flattened as in *E. abbreviata*. Also the small tubercle as found on the hind femur of the males of *E. abbreviata* is not present in this species.

**Data on Distribution:** Known only from type specimen.

***Enithares timorensis* n. sp.**

Plate III, figure 14

**Size:** Length 9.2 mm.; width of pronotum 3.5 mm.

**Color:** Variable, light and dark forms. **Light form:** Eyes brown; vertex and remainder of dorsal surface of body light brown; frons may be tinged with green; legs and abdominal venter testaceous, the latter may be dark brown with only the keel and lateral margins testaceous. **Dark form:** eyes dark brown; vertex stramineous; hind margin of pronotum hyaline and appears dark brown due to the dark brown color of the underlying scutellum; scutellum dark brown or black; hemelytra dark brown or black; legs testaceous; abdominal venter may be testaceous or dark brown.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded; vertex with its anterior width less than its length; synthlipsis wide, equal to or more than one-half the anterior width of the vertex; along the median longitudinal axis the head is equal to the length of the pronotum. Pronotum three times as broad as its median length, posterior margin almost straight; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow slightly curved forward and equal to its length removed from the membranous suture. Mesotrochanter angulate. Metaxyphus with basal lateral margins almost straight, only slightly convex and converging; apical oblique lateral margins concave and meeting in a pointed apex. Male genital capsule as shown on Plate III, figure 14. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	112	41	20
Male middle leg	100	88	33	24
Female front leg	100	102	42	23
Female middle leg	100	85	35	23

**Location of Types:** Holotype ♂, allotype ♀, Soe, Timor, 1935, Buhler in the Naturhistorisches Museum at Basel, Switzerland; paratypes are as follows: 1 ♀, Soe, Timor, June 1935, C. Buhler and Meyer; 1 ♂, Bowo, Timor, in the Snow Entomological Collections; 1 ♂, Timor, in the British Museum.

**Comparative Notes:** This species resembles *E. bergrothi* Montandon very much and can best be distinguished from it by an examination of the male genital capsule. The male genital capsule of this species has a more or less oval shaped clasper, whereas the clasper of the male genital capsule of *E. bergrothi* has an ovally swollen base with the lateral margins tapering to form an extended acuminate apex.

**Data on Distribution:** Known only from type series.

***Enithares gibbera* n. sp.**

Plate III, figure 15

**Size:** Length 8.8 mm. to 9 mm.; width of pronotum 3 mm. to 3.3 mm.

**Color:** Variable, light and dark forms. **Light form:** completely pale brown with eyes dark brown. **Dark form:** eyes brown; vertex stramineous; pronotum, immediately behind the eyed dark brown, followed by a transverse stramineous band, posterior margin of the pronotum may be hyaline and appearing black as it overlies the black anterior margin of the scutellum; scutellum black, may have two lateral triangular shaped flavus stripes, one on each side; hemelytra black with hyaline areas on clavus and corium; frons with two brown spots, one on each side of the median line and another brown spot immediately above the labrum; ventral abdominal segments dark brown; legs testaceous.

**Structural Characteristics:** As viewed from above the head is short and broad with its anterior outline rounded; vertex with its anterior width greater than its length; synthlipsis wide, at least one-half the anterior width of the vertex; along the median longitudinal axis the head is shorter than the pronotum. Pronotum with its width at least three times its median length; posterior margin concave; dorsal margin of pronotal fovea curves laterally from behind the eyes. Nodal furrow curves forward and is less than its length removed from the membranal suture, the nodal furrow may be slanting forward with only its tip curved forward. Apices of front and middle tibiae of the males prolonged into a long triangular shaped eminence of its anterior margin. Anterior tibia of males concavely indented just before the apex. First tarsal segment of the male front leg curved posteriorly with its anterior and posterior margins convex and concave respectively. First tarsal segment of the male middle leg convex on its anterior margin, posterior margin straight. The hind femora of both sexes with an indentation



on its anterior or outer margins near the base. Mesotrochanter angulate. Metaxyphus with basal lateral margins concave and diverging; apical oblique lateral margins concave and meeting in a pointed apex. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	131	38	13
Male middle leg	100	100	31	19
Female front leg	100	104	42	19
Female middle leg	100	93	33	20

**Location of Types:** Holotype ♂, allotype ♀, 3 ♂♂ and 5 ♀♀ paratypes, Guadacanal, November 2, 1944, L. J. Lipovsky, in the Snow Entomological Collections.

**Comparative Notes:** Somewhat smaller but of the same shape and coloration as the darker forms of *E. abbreviata* (Kirby). However, the males of *E. gibbera* lack the patch of black spicules as found on the ventral surface of the mesotrochanter of the males of *E. abbreviata*. The males of *E. abbreviata* lack the triangular extensions of the anterior margins of the front and middle tibiae as found on *E. gibbera*.

**Data on Distribution:** Known only from type series.

***Enithares congoensis* n. sp.**

Plate III, figure 16

**Size:** Length 6.7 mm. to 7.5 mm.; width of pronotum 2.5 mm. to 3 mm.

**Color:** Variable, reddish brown and dark forms. **Dark forms:** eyes brown speckled with black; vertex flavus or light brown; pronotum with its anterior half same color as vertex, posterior half appears black as it is hyaline and allows the black color of the underlying anterior margin of the scutellum to be seen; scutellum black, may be tinged with green at its apex; hemelytra black with hyaline longitudinal areas on the basal half of the corium and clavus. **Reddish brown form:** eyes reddish brown; vertex same color; pronotum with its anterior half black or dark brown, posterior half reddish brown; scutellum black; basal half of hemelytra orange with clavus having thin brown band bordering the scutellum and hemelytral commissure, apical half of the hemelytra dark brown or black with the exception of the clear zone of the membrane which is light brown. Both forms have legs stramineous.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded; anterior width of the vertex less than its length; synthlipsis narrow, less than one-half as wide as the anterior width of the vertex; along the median longitudinal axis the head is equal to or longer than the length of the pronotum. Pronotum at least three times as broad as its median length; posterior margin concave; dorsal margin of pronotal fovea directed laterally from behind the eyes. Nodal furrow slants forward and less than its length removed from the membranal suture. First tarsal segment of the male front leg thickened dorsally at its base. Mesotrochanter

rounded. Metaxyphus with basal lateral margins convexly curved, apical oblique lateral margins concave and meeting in a pointed apex. Male genital capsule as shown on Plate III, figure 16. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	108	32	18
Male middle leg	100	87	33	31
Female front leg	100	111	33	22
Female middle leg	100	80	32	25

**Location of Types:** Holotype ♂, allotype ♀, 1 ♀ paratype, Buta, Belgian Congo, purchased fr. Dr. O. Staudinger, Feb. 1912, in the Snow Entomological Collections; other paratype: 2 ♂♂, 3 ♀♀, Lake Onango, French Congo, A. C. Good, in the Carnegie Museum.

**Comparative Notes:** This species is about the same size as *E. blandula* Signoret. However, it lacks the black spicules as found on the anterior tibia of the latter. The male genital capsules are also greatly different, the clasper of *E. congoensis* is long, with its base swollen and the lateral margins narrowing to an acuminate apex which lies almost at the level of the dorsal margin of the posterior lobe, the clasper of *E. blandula* is short and ovoid in shape. *E. blandula* does not have the base of the first segment of the male front tarsi thickened.

**Data on Distribution:** In addition to the type series

#### Africa

Stanleyville, Congo, August 8, 1909, Land Chopin, 2 ♀ (S.E.C.).

#### *Enithares pellucida* n. sp.

Plate III, figure 17

**Size:** Length 9 mm.; width of pronotum 3.3 mm.

**Color:** Eyes brown, dark brown, or gray; vertex may be white or tan; pronotum with anterior half same color as the vertex, posterior half hyaline and appears black as it overlies the black anterior portion of the scutellum; scutellum black with two lateral triangular shaped stripes, one on each side, meeting in the apex to form a "V", or it may be entirely stramineous with only the anterior margin black; hemelytra white or stramineous and partly or wholly hyaline; legs stramineous; abdominal venter dark brown with lateral margins and keel light brown or the abdominal venter may be gray.

**Structural Characteristics:** As viewed from above the anterior outline of the head is rounded with the anterior width of the vertex equal to or less than its length; synthlipsis wide, being at least one-half the anterior width of the vertex; along the median longitudinal axis the head is less than or equal to the median length of the pronotum. Pronotum with its width slightly less than three times its median length; posterior margin concave; dorsal margin of the pronotal fovea curves laterally from behind the eyes.

Nodal furrow slanting forward and less than its length removed from the membranal suture. Anterior tibiae of both sexes with a band of black spicules on the posterior surface. Mesotrochanter rounded. Metaxyphus with basal lateral margins almost straight and parallel; apical oblique lateral margins concavely curved and meeting in a long pointed apex. Male genital capsule as shown on Plate III, figure 17. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd Tar. Seg.
Male front leg	100	104	36	19
Male middle leg	100	84	34	20
Female front leg	100	113	40	22
Female middle leg	100	81	36	19

**Location of Types:** Holotype ♂, allotype ♀, 1 ♂ and 2 ♀ ♀ paratypes, Tananarive, Madagascar, 1921, R. Decary, in the Snow Entomological Collections; 2 ♂ ♂ and 3 ♀ ♀ paratypes, same place, collector and date, in the Paris Museum.

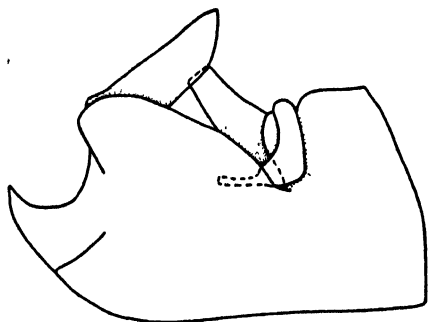
**Comparative Notes:** This species closely resembles *E. rhodopsis* Hutchinson, which appears to be confined to the mainland of Africa whereas this species is Madagascan. These two species are so similar that morphologically the male genital capsules are the best means of separating them. The posterior lobe of *E. pellucida* has its anterior margin slanting downward while that of *E. rhodopsis* is curved downward. The claspers are also shaped differently. That of *E. pellucida* has a more or less ovoid base with its apex curved forward while that of *E. rhodopsis* is ovoid in shape and not differentiated into a basal and apical region.

**Data on Distribution:** In addition to the type series.

#### Madagascar

Sikora, 1896, 1 ♂, 3 ♀ ♀ (P.M.).

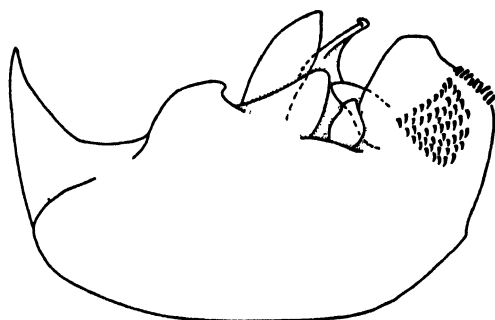
Madagascar, P. Cambque, January 13, 1914, 1 ♀ (U.S.N.M.), purchased fr. Prof. C. Lamberton, November 1913, 3 ♂ ♂, 3 ♀ ♀ (S.E.C.).



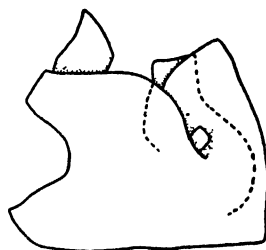
1 *E. STRIDULATA* N SP



2 *E. METALLICA* N SP



3. *E. BAKERI* N SP



4 *E. MALAYENSIS* N SP



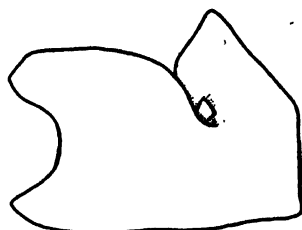
5 *E. HUNGERFORDI* N SP

# PLATE I

1. Lateral left view of the male genital capsule of *Enithares stridulata* Brooks.
2. Lateral left view of the male genital capsule of *Enithares metallica* Brooks.
3. Lateral left view of the male genital capsule of *Enithares bakeri* Brooks.
4. Lateral left view of the male genital capsule of *Enithares malayensis* Brooks.
5. Lateral left view of the male genital capsule of *Enithares hungerfordi* Brooks.



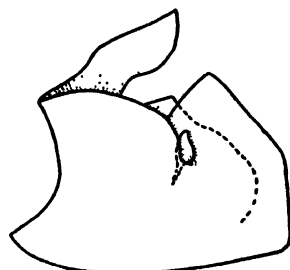
6. *E. CHINENSIS* N SP.



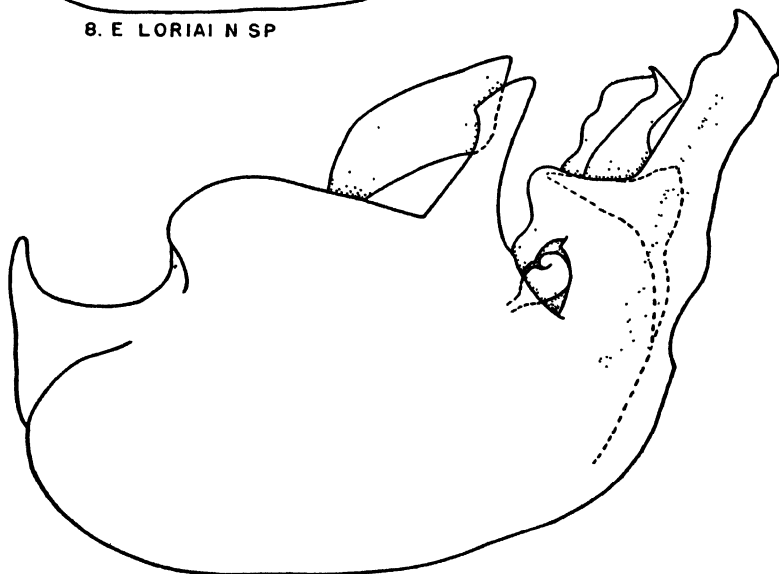
7 *E. BUHLERI* N.SP.



8. *E. LORLAI* N SP



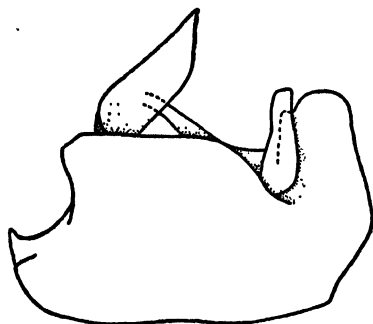
9 *E. FUSCA* N SP



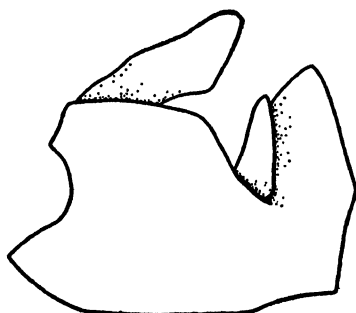
10. *E. WALLACEI* N SP

# PLATE II

11. Lateral left view of the male genital capsule of *Enithares chinensis* Brooks.
12. Lateral left view of the male genital capsule of *Enithares buhleri* Brooks.
13. Lateral left view of the male genital capsule of *Enithares lorlai* Brooks.
14. Lateral left view of the male genital capsule of *Enithares fusca* Brooks.
15. Lateral left view of the male genital capsule of *Enithares wallacei* Brooks.



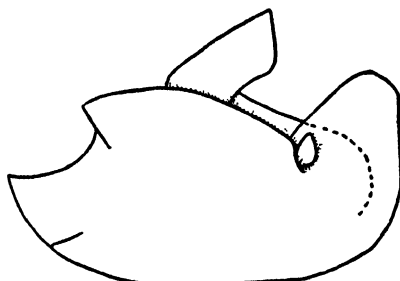
11 E ATRA N SP



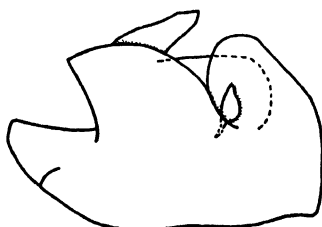
12 E FREYI N. SP.



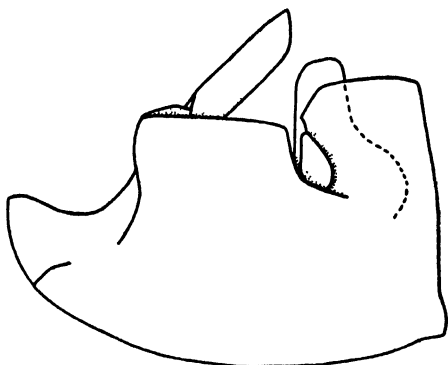
13 E FRUHSTORFERI N SP



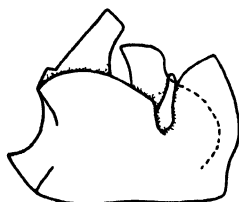
14 E TIMORENSIS N SP



15 E GIBBERA N SP



17 E PELLUCIDA N SP



16 E CONGOENSIS N SP

# PLATE III

11. Lateral left view of the male genital capsule of *Enithares atra* Brooks.
12. Lateral left view of the male genital capsule of *Enithares freyi* Brooks
13. Lateral left view of the male genital capsule of *Enithares fruhstorferi* Brooks.
14. Lateral left view of the male genital capsule of *Enithares timorensis* Brooks.
15. Lateral left view of the male genital capsule of *Enithares gibbera* Brooks.
16. Lateral left view of the male genital capsule of *Enithares congoensis* Brooks.
17. Lateral left view of the male genital capsule of *Enithares pellucida* Brooks.

REARING TECHNIQUE FOR WHITE GRUBS<sup>1</sup>

FLOYD D. MINER

University of Arkansas

A rearing method for white grubs<sup>2</sup> has been developed at the University of Arkansas which makes it possible to study the life history of isolated grubs at outside temperatures. The information secured by this method is quite complete, including habits of vertical migration. Growing plants are used as food, which adds reliability to the method.

The rearing cage consists of a section of glass tubing 22 mm. in diameter and about 24 inches long. (The length should correspond to the maximum soil depth expected of the species being reared.) The tube is closed at one end with a one-hole rubber stopper and then filled with soil to within an inch of the top. A grub is placed in the soil and the desired food plant is planted. The tube is then inserted nearly to its full length in a hole prepared in the soil of the rearing area. A snug fit should be made with the sides of the tube. This hole is ordinarily made by driving a section of water pipe into the soil. A portable shelter is placed over the tubes in rainy weather. Notes are taken by pulling the tube from the soil and making inspection through the glass. In a majority of cases the grub will be visible, at least after the first instar is passed. Care is exercised in returning the tube to the same depth.

The rearing routine is essentially as follows. Eggs are secured from adults confined in one-litre battery jars of soil which are kept sunk in the soil out-of-doors, protected during rainy weather by a cellophane shelter. Eggs are incubated in the insectary in pillboxes partially filled with packed soil. These are inspected every other day and the moldy or infertile eggs removed.

When about to hatch, the remaining eggs are placed singly in shell vials with soil and food. The egg is placed in the bottom of a tilted vial, causing the egg to lie against one side of the vial. A pinch of soil is then dropped onto the egg. With practice this can be done in such a manner that the egg remains visible through the glass. On this soil a pinch of ground "Grapenuts" is then placed, spreading it out to cover the soil so that the hatching grub is surrounded by a food supply. Then a generous amount of soil is added and rye grass seed is planted. No stoppers are used. Watering is done sparingly. Eggs are examined daily through the glass and dates of hatching recorded.

After hatching, the young grubs are held in these vials for one week after which they are removed to the permanent outside tubes. These are withdrawn from the soil periodically and the depth of the grub and stage of development noted. When the food plant is killed, another is planted. When the adult is ready to emerge, the soil is smoothed so that the first emergence can be detected and a cork stopper is placed on the tube to confine the beetle.

<sup>1</sup> Research paper No. 859, Journal Series, University of Arkansas. Published with the permission of the director of the Arkansas Agricultural Experiment Station.

<sup>2</sup> The genus *Phyllophaga* is especially referred to.

One of the merits of this method is that the grubs develop at a normal range of temperatures. It has been found that the temperature in the tube is a duplication of normal soil temperature if the tubes fit the holes tightly.

Moisture content of the soil is not nearly so well controlled, of course. A certain amount of water will enter the bottom of the tube; for the most part, however, watering is manual. For those species reared so far, soil moisture apparently has little effect within wide extremes, so that watering is governed almost entirely by the needs of the food plant.

Plants make surprisingly good growth in these tubes. Corn produces a heavy root growth in a week or two, and has been used as a standard. While such plants possibly are not altogether comparable nutritionally to field-grown plants, and are often consumed before the seedling stage is passed, they represent at least an approach to the natural food of the grubs. This is important where accuracy is desired since artificial foods may have a pronounced influence on an insect's life cycle.

Field observations have supported the accuracy of the information on seasonal history obtained by this method, insofar as such a check is possible. Adult emergence from tubes, for instance, occurs during the period of field emergence.

One weakness of the method is that the egg stage and the first week of the larval stage are spent indoors. This practice is followed because large numbers are reared through the first instar, as a precaution against any unusual mortality. Starting such a surplus by out-of-door methods would involve a prohibitive amount of time and equipment. The error introduced is probably small, since this represents a very small part of the total life history.

A compromise is also made with regard to food during the early part of the first instar. The use of the commercial breakfast food, "Grapenuts," as reported by Reinhard (1940), apparently decreases mortality during the first instar. This product is used, therefore, as a "starter" during the first week. After being transferred to the outside tubes the grubs are fed altogether on growing plants.

Although only *Phyllophaga* and *Cyclocephala* species have been reared so far in this type of cage, it should prove useful for many soil-inhabiting insects.

#### LITERATURE CITED

- Reinhard, H. J., 1940. The life history of *Phyllophaga lanceolata* (Say) and *Phyllophaga crinita* Burmeister. Jour. Econ. Ent. 33: 572-8



## DDT IN JUNIPER MEALY BUG CONTROL

LAVERE A. CALKINS\*

Iola, Kansas

DDT, in wettable powder form, or technical DDT with a wetting agent (a wax-like aerosol) added, proved to be most efficient in the control of the juniper mealy bug, *Pseudococcus juniperi* Ehrhorn, in experiments at Pratt, Kansas, during the summer of 1945.<sup>1</sup> Reinspections of sprayed trees in September, 1945, January, 1946, and April, 1946, showed complete eradication of the pest on trees sprayed a single time in 1945. These trees have been examined at intervals during the past year and were still found free of juniper mealy bug. DDT was used at the rate of 6.65 ounces of actual DDT (approximately 5 per cent by weight) to one gallon of water. While very effective, this was objectionable in leaving a heavy white residue on the trees.

A water suspension of approximately .5 ounce of technical DDT (.4 per cent by weight) with an aerosol wetting agent was tried in Wichita in July, 1945, as well as a .4 per cent and a 2 per cent of DDT oil emulsion. Results in these tests were unsatisfactory. A heavily infested tree at Pratt was dusted in August, 1945, with 50 per cent wettable powder, and a re-examination in April, 1946, revealed little control of the mealy bug.

On May 16, 1946, the writer and Mr. Dale Allen, at that time Farm Bureau Agent of Cowley County, applied a spray consisting of 8 ounces (approximately 3 per cent by weight) of 50 per cent DDT wettable powder plus approximately one-third ounce of 40 per cent nicotine sulfate (Black Leaf 40) per gallon of water to three heavily infested trees at Winfield. A power sprayer of 150 gallons capacity was employed in the spraying and apparently, to date, the one application has given complete kill except on one large native tree which could not be satisfactorily covered. The large amount of powder used resulted in some stoppage of the spray nozzles.

In July, 1946, two property owners in Wichita sprayed a number of trees at their residences with a formula, suggested by the writer, consisting of 8 ounces (approximately 3 per cent by weight) of 50 per cent DDT wettable powder plus 4 teaspoons (slightly less than .6 ounce) of Black Leaf 40 per gallon of water. To date only one tree has shown reinfestation and that appeared on new growth which was immediately resprayed with complete success.

During the summer of 1946 a third property owner in Wichita, unable to use the concentration of DDT suggested (8 ounces 50 per cent wettable powder) in his spraying equipment, made three applications of greatly reduced strength and eradicated the mealy bug.

Early in the summer of 1946 a survey of Winfield disclosed a spread of the juniper mealy bug. The city purchased a small spray outfit and took over the task of spraying infested trees under the supervision of B. F. Quis-

\* Assistant to State Entomologist.

<sup>1</sup> Calkins, L. A., Journal of the Kansas Entomological Society, Volume 19, No. 2, April, 1946, pp. 66-69.

enberry, assistant to the writer. The formula used was 4 ounces of 50 per cent DDT wettable powder (approximately  $1\frac{1}{2}$  per cent by weight) plus 4 teaspoons Black Leaf 40 (approximately .6 ounce) to each gallon of water. Eradication of the pest was complete where full coverage was secured, but the spraying equipment was inadequate to reach the top of large trees and a further spread was noted in September, 1947. Again the city, using a larger sprayer, applied the DDT formula with excellent results when coverage was complete.

Late in February, 1946, the writer and his assistant, Jose Hidalgo, Jr., surveyed cedars in the city of Great Bend, finding several severe infestations. Mr. H. O. Schrepel, a local nurseryman, sprayed these properties during the following summer with the DDT-nicotine sulfate formula used at Winfield and obtained excellent results. Hot weather and little or no rainfall, ideal conditions for the development of the insect, prevailed during the summers of 1946 and 1947 and new infestations continued to develop. These were sprayed by Mr. Schrepel as they appeared and apparently were cleaned up.

On April 22, 1947, the writer treated one infested tree on each of two properties with a spray consisting of 4 ounces (approximately  $1\frac{1}{2}$  per cent by weight) of 50 per cent DDT wettable powder, plus 2 teaspoons of NNOR, a liquid containing rotenone, to each gallon of water. Two gallons of material were used on one tree and one and a half gallons on the other, the applications having been made by means of a three-gallon compressed air sprayer. The following day two additional tests of like character were set up, the formula being changed to 2 ounces of the 50 per cent DDT in one case and one ounce in the other, with two gallons of material used per tree. On the day following a hard rain which fell on April 24, the residual DDT was still evident. On June 28, August 11, September 22, October 1, and November 22 these properties were reinspected and no reinfestation had appeared. New growth was excellent, considering the extreme dryness of the summer.

An experiment on two heavily infested red cedars was made on September 22, 1947, in Wichita to determine if a small amount of material would eradicate the mealy bug. About two gallons of spray, consisting of 2 ounces of 50 per cent DDT wettable powder plus 2 teaspoons of NNOR per gallon of water, were applied to the two trees. On November 22 an examination disclosed no further damage, but a small number of live adults and numerous crawlers or nymphs was present. There were large numbers of parasitized adults, the larvae of the parasite, probably a chalcid wasp, appearing to be alive. It is hoped that observations in the spring and early summer of 1948 will show that the parasites may be able to overcome the remaining mealy bugs.

While the use of DDT in the strengths employed by the writer makes spraying for juniper mealy bug an expensive control, the results appear to justify the expense.

The attack of *Pseudococcus juniperi* Erh. on red cedar varieties has been persistent and in many cases very swift to cause great damage to beautiful and valuable trees. During the past summer the writer observed several

instances of damage to cedars which had very probably been infested at the time of planting and had only become noticeably damaged during the past season. The length of time since planting varied from several months to as long as eight or nine years. Natural enemies and unfavorable weather conditions no doubt play important roles in holding back damage by this insect, but given suitable conditions for development, the mealy bug can speedily ruin valuable evergreens. In localities where juniper mealy bugs are known to be present, the writer feels that protective spraying, as well as eradica-tive measures, should be undertaken.

### Summary

The juniper mealy bug can be eradicated from heavily infested trees of the red cedar varieties by the use of 4 ounces (approximately 1½ per cent by weight) of 50 per cent DDT wettable powder plus 2 teaspoons of NNOR (a commercial material consisting of a synergistic wetting agent and a spreader, plus rotenone) to each gallon of water, applied as a spray, thoroughly wetting the trunk and foliage of the infested tree. For protective spraying it is suggested that only 2 ounces of the 50 per cent DDT wettable powder be used instead of the 4 ounces given for evident infestation.

## A NEW *LONATURA* AND *PARABOLOCRATUS* (Homoptera-Cicadellidae)

R. H. BEAMER\*

### *Lonatura teretis* n. sp.

Resembles *Lonatura punctifrons* Beamer but easily separated from it by having a single black spot on apex of crown and by the white band on apex of elytra of short-winged form. Length ♂ 2.5 mm; ♀ 3.2 mm.

**Structure:** Crown subconical, broadly rounded; elytra of brachypterous form about as long as head and pronotum, apices truncate, costal margin longest.

**Color:** General ground color stramineous; crown with three irregular margined black spots, one at apex, and a pair between this and eyes; elytra semihyaline with narrow white band on apices; dorsum of abdomen with basal half black, remainder of segment lighter, mostly white; pygofer with basal two thirds black, remainder buff; front with narrow black band between antennae strongly arched toward union with clypellus; venter of abdomen in female mostly light, in male segments dark with light outer border; valve dark brown, plates much lighter.

**Genitalia:** Female last ventral segment slightly less than twice as long as preceding, posterior margin with a shallow notch either side of middle; male

\* Contribution from the Department of Entomology, University of Kansas, Lawrence, Kansas.

valve large, broadly rounded; plates almost as broad as long, evenly narrowed on outer margin to sharp apices; aedeagus with broad, thin flange on ventral margin of outer half, apex with a lateral retrorse process, slightly longer than width of shaft at tip.

Holotype ♂, allotype ♀, 46 ♀ and 53 ♂ paratypes, Rabbit Ear Pass, Colorado, August 5, 1947, R. H. Beamer. Types in the Snow Entomological Collections.

***Parabolocratrus hepnerei* n. sp.**

Resembling *Parabolocratrus atascaderus* Ball but smaller with dark color on dorsum of abdomen of both males and females instead of just a wedge on venter of males. Length ♂ 4.5-5-mm.; ♀ 6-7 mm.

**Structure:** Crown about one and one third times as wide between eyes as length at middle, flat, margin sharp, broadly rounded, apex forming considerably more than a right angle; elytra of most specimens reaching on to fourth abdominal segment in female, almost to pygofer in male; pygofer in male on ventral margin enlarged beyond base with distinct, sharp notch just before middle, narrowed beyond this to sharp apices.

**Color:** General color of dorsum greenish yellow. Male: vertex usually margined with darker, veins of elytra light brown; dorsum of abdomen dark brown except narrow hind margin of each segment light; venter more or less brown, front almost black; segments of abdomen dark brown except very narrow posterior border very light. Female: elytra with veins light brown; abdomen with a pair of broad, longitudinal, brown stripes beginning about apex of elytra and ending at apices of pygofers; venter stramineous, ovipositor, legs and front darker, front nearly black at union with crown.

**Genitalia:** Male plates long, slender, flaring on outer third, apices sharp; valve short, angular; aedeagus in dorso-ventral view with shaft long and straight, sides very slightly narrowed to apical sixth where it suddenly narrows to apical width, apex divided into two narrow, parallel-margined recurving processes.

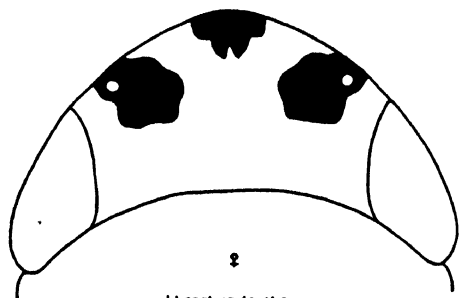
Holotype ♂, allotype ♀, 32 ♂ and 48 ♀ paratypes, Garden City, Kansas, June 12, 1946, R. H. Beamer. Types in Snow Entomological Collections.

The above specimens were taken from *Calamovilfa longifolia* Hack where they were closely attended by rather large reddish ants. In fact, the easiest way to locate the leafhoppers was to select a stem of the above grass with these red ants running about on it. The leafhoppers were laying eggs, row upon row of them, in the leaf sheaths at the base of the leaves.

I take great pleasure in naming this leafhopper for Doctor Leon Hefner who is tremendously interested in the taxonomy of the Cicadellidae.

**EXPLANATION OF PLATE**

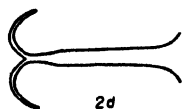
- 1 Dorsal view of head of female *Lonatura teretis* Beamer
- 1a Lateral view of aedeagus of *Lonatura teretis* Beamer.
- 1b Dorso-ventral view of tip of aedeagus of *Lonatura teretis* Beamer
- 2 Dorsal view of abdomen of female of *Parabolocratrus hepnerei* Beamer
- 2a Dorsal view of head of female of *Parabolocratrus hepnerei* Beamer
- 2b Dorsal view of head of male of *Parabolocratrus hepnerei* Beamer
- 2c Ventral view of male genital capsule of *Parabolocratrus hepnerei* Beamer
- 2d Dorso-ventral view of aedeagus of *Parabolocratrus hepnerei* Beamer.
- 2e Lateral view of head of male of *Parabolocratrus hepnerei* Beamer



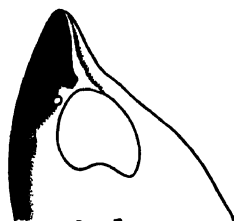
1 *Londura teretis*



1a



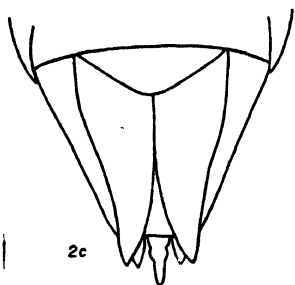
2d



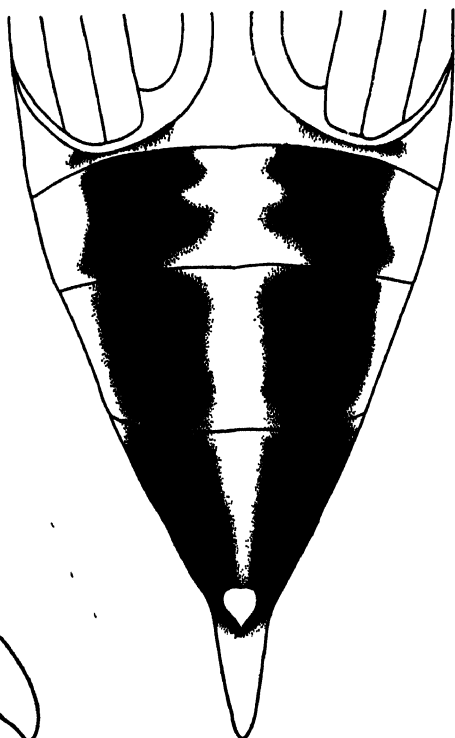
2e ♂



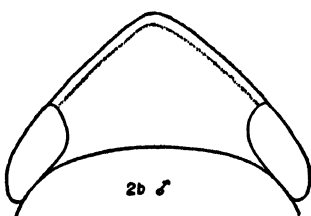
1b



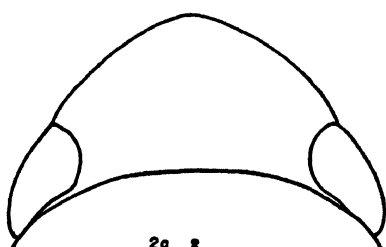
2c



2Parabolocratus hepneri



2b ♂



2a ♀

## RECORDS OF THREE SPECIES OF DYTISCIDAE NEW TO THE UNITED STATES (Coleoptera)

HUGH B. LEECH

*California Academy of Sciences, San Francisco*

The specimens upon which the following records are based were recognized as new to the United States list, and were submitted to Mr. J. Balfour-Browne of the British Museum for identification. He compared them with Sharp's types. I am indebted to him, and to Mr. J. W. Green for permission to give notice of the *Laccophilus* he took in Arizona.

### *Laccophilus apicalis* Sharp

*Laccophilus apicalis* Sharp, 1873, Ent. Mo. Mag. 10(3):53; Sharp, 1882, Sci. Trans. Roy. Dublin Soc. (2) 2:291; 1882, Biol. Centr.-Amer., Coleopt. 1(2):10; 1887, op. cit. 1(2):749

Described from Nicaragua, and known from Guatemala, Panama, and Mexico. It resembles *L. fasciatus* Aubé and strongly marked examples of *terminalis* Sharp, but is broader than the former, with the postmedian dark elytral fascia a third again as wide. In the male the interspaces of the metacoxal file are narrower than the impressed lines and convex, not broad and flat as in the other two species.

Bear Canyon, Tucson, Ariz., March 26, 1946 (J. W. Green).

### *Laccophilus confusus* Sharp

*Laccophilus confusus* Sharp, 1882, Sci. Trans. Roy. Dublin Soc. (2) 2:292; 1882, Biol. Centr.-Amer., Coleopt. 1(2):11; 1887 op. cit. 1(2):749.

Previously known from Mexico. A small species, resembling *proximus* Say and small examples of *terminalis*, but narrower than either and dark beneath. The metacoxal file of the male is reduced, very lightly impressed, with the interspaces flat and comparatively broad.

Bear Canyon, Tucson, Ariz., March 18 and 26, 1946 (J. W. Green).

### *Copelatus debilis* Sharp

*Copelatus debilis* Sharp, 1882, Sci. Trans. Roy. Dublin Soc. (2) 2:579; 1882, Biol. Centr.-Amer., Coleopt. 1(2):37.

Described from Nicaragua and Guatemala; recorded in the literature from Brazil, Panama, and Mexico. A small, narrow species which traces to couplet 3 in Schaeffer's key (1908. New York Ent. Soc., Jour. 16(1):17). It will not fit either choice there, since there are but five discal striae on each elytron.

Brownsville, Texas, November 18, 1932 [Armstrong]; Brownsville, Tex., July 24, 1942 (E. S. Ross).

## THE RELATION OF TEMPERATURE IN THE SUSCEPTIBILITY OF GRASSHOPPERS TO SYNTHETIC INSECTICIDE DUSTS<sup>1</sup>

W. C. RHOADES AND CHARLES H. BRETT

Kansas State Agricultural College, Manhattan, Kansas

### Introduction

Considerable variation in the effectiveness of synthetic insecticide dusts has appeared in reports of experiments conducted in different areas. The probability that temperature was one of the important factors resulted in the carrying out of tests under different controlled temperatures as reported in this paper.

### Materials and Methods

Adults of the differential grasshopper, *Melanoplus differentialis* (Thomas), the two-lined grasshopper, *M. bivittatus* (Say), and the lesser migratory grasshopper *M. mexicanus* (Sauss.) were collected in the field during October, 1946, brought into the laboratory and used as a source of egg supply. Care was taken to select vigorous females for this purpose. These grasshoppers were held in screen wire cages (10"x14"x18") in which five 4-ounce jars filled with moist sand were placed. Eggs were deposited readily in these jars. After deposition they were stored in a refrigerator at 40° F. for a period of at least two weeks. They were then placed in an incubator at a constant temperature of 80.6° F. Grasshoppers hatching from these eggs were reared to the adult stage on head lettuce and used as test insects. Some tests were made with adult and nymphal grasshoppers collected directly from the field.

Laboratory tests were made with dusts containing 5 percent gamma benzene hexachloride, 20 percent chlorinated camphene (3956), 10 percent chlordan, 20 percent DDT and 2 percent parathion (3422).

Ten grasshoppers were placed in a common two-quart fruit jar. A piece of screen wire was cut, fitted into the ring of the jar lid and used as a cover. A small hole the size of a lead pencil was punched in the screen cover to allow a V-shaped glass tube of the same diameter to be placed in the jar for applying dust to the grasshoppers. Fifty milligrams of dust were put into the glass tube and allowed to settle in the bottom of the "V." A rubber bulb was attached at one end of the tube. The open end was inserted through the opening in the screen cover. One vigorous squeeze of the rubber bulb forced all dust into the jar and distributed it evenly. After five minutes the grasshoppers were transferred to a small screen cage (6"x6"x10") where food was available, and then placed in a constant tem-

<sup>1</sup>A portion of a thesis presented by the senior author in partial fulfillment for the Master of Science degree at the Oklahoma Agriculture and Mechanical College, Stillwater, Okla., July, 1947.

perature compartment. The temperatures used in these tests were 70° F., 80° F., 90° F., and 100° F. Observations were made at 2, 4, 8, 24, 48, and 72 hour intervals. For some of the tests, observations were made over a longer period of time. Some fumigation tests were made by inverting screened jars containing grasshoppers over jars containing insecticidal materials and sealing them together with adhesive tape.

### Results

Grasshoppers treated with 5 percent gamma benzene hexachloride were affected and killed more quickly as temperatures became progressively higher (Table 1). The best results were obtained at 100° F. At this temperature all individuals were dead by the end of 24 hours. At other temperatures all grasshoppers treated with benzene hexachloride died or were affected.<sup>2</sup> Those which were not killed recovered, copulated, and produced viable eggs.

Chlorinated camphene showed a temperature relationship, but the difference in susceptibility at high and low temperatures was less than for benzene hexachloride. It was also slower acting. Maximum mortality was not reached until at the end of 72 hours when all individuals were dead except 15 percent of the differential grasshoppers at 70° F.

Chlordan also showed a relation to temperature, being slightly more toxic at the higher temperatures. One hundred percent mortality did not occur with *M. differentialis* or *M. bivittatus* at any of the four temperatures, but all migratory grasshoppers, *M. mexicanus*, were dead at the end of 48 hours at 100° F.

DDT did not give high percentage kills. In contrast to the other insecticides, grasshoppers appeared to be more susceptible at the lower temperatures. A maximum mortality of 60 percent occurred at 70° F. after 72 hours on lesser migratory grasshoppers.

Parathion showed a definite temperature relationship. Two-lined grasshoppers treated with 2 percent dust and placed in the constant temperature compartments were affected in greater numbers or killed more quickly as the temperatures became progressively higher. The best results were obtained at 90° F. and 100° F. At these temperatures all individuals were dead at the end of 8 hours. This relationship was also evident in large scale field tests run at high and low temperatures in Oklahoma.<sup>3</sup>

Table 2 shows little difference between the susceptibility of the three species of grasshoppers to the synthetic insecticides. Increased susceptibility at high temperature may be partially due to the fumigation action of certain of the insecticides. This was more pronounced with benzene hexachloride and parathion than with chlordan and chlorinated camphene. Benzene hexachloride showed definite fumigating action. High temperature apparently increased the rate of gaseous release from this chemical.

<sup>2</sup> Grasshoppers were considered to be affected when they stumbled about showing loss of co-ordination accompanied by nervous tremors.

<sup>3</sup> Results submitted for publication in the Journal of Economic Entomology.



TABLE I

Relation of temperature in the susceptibility of three economic species of grasshoppers, *Melanoplus differentialis*=(Dif.), *M. bistrattus*=(Biv.), and *M. mexicanus*=(Mex.) to synthetic insecticides applied as contact dusts.<sup>1</sup>

Insecticide	Hours after Treatment	Percent Mortality											
		70						Constant Temp. Degrees F. 90					
		Dif.	Biv.	Mex.	Dif.	Biv.	Mex.	Dif.	Biv.	Mex.	Dif.	Biv.	Mex.
Gamma Benzene Hexachloride, 5 percent	4	0	20	0	5	10	0	15	40	20	40	60	50
	8	0	30	10	10	50	20	40	70	40	75	90	90
	24	80	100	80	90	100	100	100	100	100	100	100	100
	48	80	100	80	90	100	100	100	100	100	100	100	100
Chlorinated Camphene, 20 percent	72	80	100	80	90	100	100	100	100	100	100	100	100
	4	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	10	10	5	0	20	0	0	30
	24	50	60	70	50	70	80	80	90	90	75	90	90
Chlordan, 10 percent	48	80	90	90	75	90	100	100	100	100	100	100	100
	72	85	100	100	100	100	100	100	100	100	100	100	100
	4	0	0	0	0	0	0	0	0	0	0	0	0
	8	10	0	0	10	0	10	20	10	20	20	20	30
DDT, 20 percent	24	50	50	40	50	50	60	60	60	50	70	70	90
	48	70	70	70	70	70	70	80	80	70	80	80	100
	72	70	70	80	80	80	80	80	80	90	80	80	100
	4	0	0	0	0	0	0	0	0	0	0	0	0
Parathion, 2 percent	8	0	0	0	0	0	0	0	0	0	0	0	0
	24	20	20	20	20	20	20	10	20	20	0	0	20
	48	40	40	40	40	40	40	20	30	30	10	20	30
	72	50	50	60	40	40	40	30	30	40	30	30	30
Parathion, 2 percent	4		15			40			50			35	
	8		75			80			90			100	
	24		95			100			100			100	
	48		95			100			100			100	

<sup>1</sup> Each entry in table represents 10 replicates of 10 insects each.

Uvarov (2)<sup>4</sup> states that the influence of temperature plays an important part in the respiratory movements of grasshoppers. These movements increase from an average of 5.9 per minute at a temperature of 9.5° C. (49.1° F.) to 26.6 per minute at a temperature of 26.6° C. (79.88° F.).

Krogh (1) studied the composition of the air in the tracheal system of the hind leg of a grasshopper and found that the oxygen percentage may be as high as 20 percent during rest but after exhausting muscular exercise it is reduced to 5 percent. Thus, if the insecticide is applied at high temperatures where grasshopper activity is greatest, more of the toxic gas may be taken in to replace oxygen than when grasshoppers are comparatively inactive at low temperatures.

DDT does not act as a fumigant. It is slow in its action and is taken up by absorption through the fatty tissues. The grasshoppers are sluggish at low temperatures and the rate of metabolism slower. Perhaps this reduces the rate at which DDT is eliminated and thus allows a lethal concentration to be reached more quickly.

A good contact dust for grasshopper control should act quickly in order that further damage by the insects may be prevented. Residual qualities are desirable for continued control throughout the hatching period or to kill grasshoppers which migrate into the area. Low toxicity to warm blooded animals is very important and low cost in the application of the insecticide is of prime importance. Not all of these features are fully realized as yet in the use of any of the synthetics but a great step forward has been made in grasshopper control.

### Summary

Laboratory tests were made on three economic species of grasshoppers, *Melanoplus differentialis*, *M. bivittatus*, and *M. mexicanus mexicanus* to determine their susceptibility to certain synthetic insecticide dusts under different constant temperatures.

Two percent parathion and five percent gamma benzene hexachloride were the most effective materials tested. The parathion dust was more rapid in its action, reaching peak kill in 8 hours at 100° F. as compared to 24 hours for benzene hexachloride. Increase in temperature reduced the time required to reach peak mortality and increased the percentage of grasshoppers killed by these materials. Fumigating action was very evident with benzene hexachloride.

Twenty percent chlorinated camphene and ten percent chlordan were slower acting, requiring from 48 to 72 hours to reach peak mortality. High temperature increased their effectiveness to a lesser extent. Chlordan was less effective than the other materials except DDT, in its action as a contact toxin.

Twenty percent DDT dust was somewhat more effective at the lower temperatures. This material was slow acting and did not give high percentage mortalities.

<sup>4</sup> Numbers in parenthesis refer to literature cited.

There was little difference in the relative susceptibility of the three kinds of grasshoppers to the different insecticides. (Table 2).

### Literature Cited

(1) KROGH, A.

The composition of the air in the tracheal system of insects. Skand. Arch. Physiol. 29:29-36. 1913.

(2) UVAROV, B. P.

Locusts and grasshoppers. A handbook for their study and control. Imperial Bureau of Entomology. William Clowes and Sons. London and Beccles. 1928.

**TABLE 2.**

Comparative susceptibility of three economic species of grasshoppers to synthetic insecticides applied as contact dusts.

Insecticide	Average Percent Mortality of all Temperature Tests					
	Melanoplus differentialis		Melanoplus bivittatus		Melanoplus mexicanus	
	24 hrs.	72 hrs.	24 hrs.	72 hrs.	24 hrs	72 hrs.
Benzene hexachloride, 5 percent gamma	92	92	100	100	95	95
Chlorinated camphene, 20 percent	63	96	77	100	82	100
Chlordan, 10 percent	57	77	57	77	80	85
DDT, 20 percent	7	37	15	37	20	42
Avg. for all treatments	55	75	62	78	64	80





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## SOME NEW SPECIES OF RHAGOVELIA (Hemiptera, Veliidae)

JOHN A. BACON\*  
Lawrence, Kansas.

During the course of a taxonomic study of the genus *Rhagovelia* Mayr under the direction of Dr. H. B. Hungerford several new species have been discovered among the recently collected material in the Francis Huntington Snow Entomological collections.

### *Rhagovelia bisignata* n. sp.

(Fig. 1.)

Size:	Length	Width
	3.23 mm. apterous ♂	1.26 mm. apterous ♂
	3.82 mm. apterous ♀	1.33 mm. apterous ♀
	3.52 mm. winged ♂	1.46 mm. winged ♂
	3.82 mm. winged ♀	1.40 mm. winged ♀

**Color:** General color brown-black, clothed with brown pubescence. Head with impressed median line well defined, with two or three spots on each side, the lateral converging lines not meeting at the base to form a perfect "V". Pronotum with broad transverse band of lighter gray on apical three-fourths and with median area orange. Venter gray. Base of antennae, the anterior coxae, posterior coxae, and the posterior trochanters pale yellow to brown-orange. Mesonotum of apterous forms with shining black triangle each side of median line with apex directed posteriorly. Margins of connexiva black. Apterous male with median area of venter of last segment and genital segments black; shining black spots on dorsum of last two or three abdominal segments. Apterous female with shining black spots on dorsum of last seven segments of the abdomen.

**Structural Characteristics:** Head, sides of body, two basal segments of antennae, and all legs with long hairs and a few scattered setae. Pronotum in apterous forms sutured off from mesonotum. **Apterous male:** anterior trochanters unarmed; anterior tibiae not dilate and moderately sinuate. Pronotum wider than long (L. 14, W. 70); mesonotum with width subequal to length (L. 70, W. 72) and nearly covering the median portion of mesonotum. Proportions of antennae: Seg. I: II: III: IV: : 78: 48: 45: 38; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III: : 170: 100: 65: 58; of posterior legs: 135: 144: 8: 24. Connexiva wide near base and tapering posteriorly, the angle of taper increasing about the sixth abdominal segment. Venter with slight median carina which becomes pronounced on last abdominal segment. Posterior trochanter unarmed. Posterior femur not incrassate (L. 135, W. 11), armed with one brown spine at apical two-sevenths and

\*Contribution from the Department of Entomology, University of Kansas.

with two or three very small teeth from there to apex. Posterior tibia straight and unarmed, or armed only with a very small brown spur at apex. **Apterous female:** proportions of antennae: 75: 46: 47: 36; of intermediate legs: 165: 95: 63: 60; of posterior legs: 135: 144: 8: 24. Posterior femur armed as in male. **Winged forms:** proportions of legs and antennae, and armature of posterior femur as in apterous forms. Pronotum not produced into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; paratypes, 10 apterous ♂♂, 11 apterous ♀♀. Described from series from Tamazunchale, Mexico, S. L. P. 7-20-37, H. D. Thomas. Allomorphotype, winged ♀, from Guatemala El Salto, Escuintla, 1934, F. X. Williams. All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near *Rhagovelia regalis* D. & H from which it differs in the proportions of the legs and in the shape of the male clasper. It can be told from all other *Rhagovelia* by the nature of the markings of the mesonotum when these markings are distinct.

**Data on Distribution:**

Mexico: Tamazunchale S. L. P. 7-20-37, H. D. Thomas. (Type series). 11 apterous ♂♂, 1 winged ♂, 12 apterous ♀♀.

Acapulco Gro, July 12, 1937, H. D. Thomas. 1 apterous ♂, 4 apterous ♀♀, 4 nymphs.

El Sabino Uruapan Mich Mex., 7-24-36, H. D. Thomas. 32 apterous ♂♂, 28 apterous ♀♀.

Guatemala: El Salto Escuintla, 1934, F. X. Williams. 9 apterous ♂♂, 2 winged ♂♂, 19 apterous ♀♀, 5 winged ♀♀ (includes allomorphotype).

Trib Rio Negro, N. Salama, 4-22-47, M 47 47, R. R. Miller. 1 apterous ♀.

Costa Rica: San Jose C. A. 6 & 7, 1931, Heinrich Schmidt. 4 apterous ♂♂, 4 apterous ♀♀.

***Rhagovelia deminuta* n. sp.**

(Fig. 8)

Size:	Length	Width
	2.42 mm. apterous ♂	0.97 mm. apterous ♂
	2.80 mm. apterous ♀	1.03 mm. apterous ♀

**Color:** General color gray-black, clothed with gold-brown pubescence. Pronotum orange with gray spots at each lateral margin. Venter gray. Base of antennae, base of anterior femora, all coxae and trochanters yellow. Posterior femora with distal and apical quarters yellow to tan and middle half of femora brown. Venter of last abdominal segment and genital segment brown to orange-brown. Margins of connexiva orange.

**Structural Characteristics:** Fusiform. Pronotum sutured off from mesonotum in apterous form. **Apterous male:** anterior trochanters unarmed; anterior tibiae slightly dilate and flattened on the ventral surface. Pronotum

wider than long (L. 8, W. 48); mesonotum truncate (L. 42, W. 57) and nearly covering the median portion of metanotum. Proportions of antennae: Seg. I: II: III: IV:: 43: 22: 28: 32; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 100: 75: 38: 43; of posterior legs: 75: 75: 2: 16. Abdomen tapering evenly to apex. Abdomen without ventral carina. Posterior trochanter unarmed. Posterior femur moderately incrassate (L. 75, W. 20) and armed with one long, yellow, brown-tipped spine at the middle and from there to the apex with six or seven decreasing spines. Posterior tibia not sinuate and armed on the basal half with a few very short teeth; armed at apex with a small spur. **Apterous female:** proportions very similar to the male. Proportions of antennae: 45: 22: 28: 31; of intermediate legs: 100: 75: 40: 46; of posterior legs: 80: 80: 2: 19. Posterior femur not quite so incrassate as in the male (L. 80, W. 20); armed as in the male. Posterior tibia armed as in the male. **Winged forms:** unknown.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; paratypes, 87 apterous ♂♂ and 49 apterous ♀♀. Described from specimens labeled: 'British Guiana, Supuruni Creek, August 12, 1937, S. Harris.' All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is most nearly related to *Rhagovelia siroa* Gould but does not have the ventral abdominal spine which characterizes *R. spinosa*. It can be told at a glance by the light colored area at the apical quarter of the posterior femur.

**Data on Distribution:**

British Guiana: Supuruni Creek, August 12, 1937, S. Harris. (Type series).  
88 ♂♂, 50 ♀♀.

***Rhagovelia evidis* n. sp.**

(Fig. 6)

Size:	Length	Width
	2.50 mm. apterous ♂	1.03 mm. apterous ♂
	2.93 mm. apterous ♀	1.13 mm. apterous ♀

**Color:** General color black, clothed with a very fine brown pubescence. Head with usual impressed lines. Pronotum gray with a faint orange band at middle. Venter blue-gray. Base of antennae, base of anterior and very small portion of base of posterior femora, all coxae and trochanters yellow. The posterior and intermediate tibiae and all tarsal segments brown. Margins of connexiva black. Apterous male with shining black spot on dorsum of last abdominal segment; venter of last abdominal segment black with a small blue-gray triangle with base on the anterior margin of the segment. Apterous female with shining black spot on dorsum of last two abdominal segments.

**Structural Characteristics:** Fusiform. Widest through mesothorax. Usual long hairs and setae present. Pronotum sutured off from mesonotum in apterous forms. **Apterous male:** anterior trochanters armed only with a small tuft of dark brown hair; anterior tibiae not dilate, only very slightly flattened on the ventral surface. Pronotum wider than long (L. 12, W. 59);

mesonotum truncate (L. 47, W. 60) and nearly covering the median portion of metanotum. Proportions of antennae: Seg. I: II: III: IV:: 50: 27: 30: 29; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 106: 73: 40: 48; of posterior legs: 83: 83: 6: 16. Abdomen tapering evenly to apex. Venter of last abdominal segment with a slight carina extending only on the apical half with the segment slightly depressed to each side. Posterior trochanter unarmed. Posterior femur slightly incrassate (L. 83, W. 17) and armed with a long, black spine at the middle, followed by six or seven rapidly decreasing spines from there to apex. Posterior tibia straight and armed only with a small spur at the apex. Apterous female: proportions of antennae: 50: 27: 32: 29; of intermediate legs: 110: 75: 40: 48; of posterior legs: 83: 90: 6: 18. Connexiva slightly reflexed over last three abdominal segments. No ventral carina. Posterior trochanter unarmed. Posterior femur less incrassate than in male (L. 83, W. 15); armed slightly beyond the middle with a slender spine and from there to apex with approximately four decreasing spines. Posterior tibia straight and unarmed. Dorsum of first two abdominal segments arched above; third to sixth depressed so as to form a shallow trough. **Winged forms:** unknown.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; paratypes, 5 apterous ♂♂ and 8 apterous ♀♀. Described from specimens labeled: "Brazil, S. A., 9-25, 10-17-36, A. M. Olalla Vic. Santo Antonio, River Eiru, No. 3712." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near *Rhagovelia tantilla* D. & H. from which it can be separated by its smaller size, the spur on the posterior tibia, the color of the intermediate trochanters, the structure of the last ventral abdominal segment of the male and the shape of the male clasper which is more pointed than that of *R. tantilla*.

**Data on Distribution:**

Brazil, S. A.: Vic Santo Antonio, River Eiru, 9-25, 10-17-36. A. M. Olalla. (Type series). 6 apterous ♂♂, 9 apterous ♀♀.

***Rhagovelia fontanalís* n. sp.**

(Fig. 2)

Size:	Length	Width
	3.45 mm. apterous ♂	1.13 mm. apterous ♂
	3.86 mm. apterous ♀	1.26 mm. apterous ♀
	4.33 mm. winged ♂	1.39 mm. winged ♂
	4.45 mm. winged ♀	1.46 mm. winged ♀

**Color:** General color dark brown, clothed with fine brown pubescence. Head with usual impressed lines. Pronotum gray with median area orange; posterior third of pronotum same color as mesonotum. Margins of connexiva black. Venter blue-gray. Basal half of first segment of antennae, all acetabulae, coxae, anterior and posterior trochanters, basal half of anterior femora, basal half of intermediate trochanter, and basal fifth of posterior femora yellow to yellow-brown. Broad, shining black spots occupying

nearly the whole dorsum of abdominal segments on all but first segment; the markings of the first segment usually smaller than that of the remaining segments, or may be absent. The last abdominal segment and genital segments of male orange; of female brown to black.

**Structural Characteristics:** Fusiform. Usual long hairs and setae present. Pronotum sutured off from mesonotum in apterous forms. **Apterous male:** anterior trochanters unarmed. Anterior tibiae slightly dilate and excavate on the apical fifth. Pronotum much wider than long (L. 15, W. 65); mesonotum also wider than long (L. 55, W. 67) and nearly covering the metanotum. Proportions of antennae: Seg. I: II: III: IV:: 60: 34: 40: 36; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 123: 87: 41: 50; of posterior legs: 105: 110: 11: 22. Abdomen tapering to apex, angle of taper increasing for last three segments. Venter without median carina. Posterior trochanter unarmed. Posterior femur very slightly incrassate (L. 105, W. 16), no wider than the base of the intermediate leg; armed with one curved spine at the middle, followed with four or five very short spines to the apex. Posterior tibia straight and unarmed. **Apterous female:** proportions of antennae: 63: 34: 39: 37; of intermediate legs: 134: 93: 45: 54; of posterior legs: 108: 115: 12: 23. Posterior femur very slightly incrassate; armed slightly beyond the middle with one short spine, and from there to apex with five or six very short spines, or may be armed only with the spine slightly beyond the middle, or unarmed. Posterior tibia straight and without a spur at the apex. **Winged forms:** proportions of legs and antennae, and armature of posterior femora the same as for the apterous forms. Tips of wings extend well over the apex of the abdomen. Pronotum not produced into an elongate process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; allomorphotype, winged ♀; paratypes, 6 apterous ♂♂, 12 apterous ♀♀; paramorphotypes, 7 winged ♂♂, 5 winged ♀♀. Described from series labeled: "Peru, S. A., Oct. 10, 1935, F. Woytkowski, Field note 3562, Vic Sani Beni, 840 m. a. s. l. Canal supplying drinking water." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is close to *Rhagovelia evidis* n. sp. from which it can be separated by its proportions, and armature of the posterior femur. The genitalia are also quite distinct.

#### **Data on Distribution:**

Peru, S. A., Vic Sani Beni, 840 m. a. s. l. Canal supplying drinking water, Oct. 10, 1935, F. Woytkowski. Field note 3562. (Type series).  
7 apterous ♂♂, 8 winged ♂♂, 13 apterous ♀♀, 6 winged ♀♀.

Vic Sani Beni, 840 m. a. s. l. Brooks and pools of Sani Beni, Aug. 31, 1935, F. Woytkowski. Field note 3560. 12 apterous ♂♂, 1 winged ♂, 6 apterous ♀♀, 1 winged ♀.

Vic Sani Beni, 840 m. a. s. l. River Sani Beni, Sept. 5, 1935, F. Woytkowski. Field note 3551. 3 apterous ♂♂, 2 winged ♂♂, 6 apterous ♀♀, 2 winged ♀♀.



- Vic Sani Beni, 840 m. a. s. l. In River Sani Beni, July-Aug., -1935, F. Woytkowski. Field note 3553b. 1 apterous ♀, 1 winged ♀.
- Vic Sani Beni, 840 m. a. s. l. Tiny brook in jungle. Oct. 10, 1935, F. Woytkowski. Field note 3557. 1 apterous ♀.
- Vic Sani Beni, 840 m. a. s. l. From River, Oct. 9, 1935, F. Woytkowski. Field note 3548. 1 winged ♂, 1 winged ♀.
- Vic Sani Beni, 840 m. a. s. l. Brook on open cultivated land, Oct. 12, 1935, F. Woytkowski. Field note 3566. 2 apterous ♂ ♂.
- Vic Sani Beni, 840 m. a. s. l. River S. Beni and adj. pools. Aug. 5, 1935, F. Woytkowski. Field note 3553d. 1 apterous ♀.
- Vic Rio Negro, 790 m. a. s. l. River R. Negro, Oct. 28, 1935, F. Woytkowski. Field note 3568. 2 apterous ♀ ♀.
- Vic Rio Negro, 790 m. a. s. l. in R. Negro, Nov. 4, 1935, F. Woytkowski. Field note 3553e. 5 apterous, ♂ ♂, 1 winged ♂, 1 apterous ♀.
- Vic of San Pedro, 900 m. a. s. l. Jungle pools, May 15-29, 1935, F. Woytkowski. 3 apterous ♂ ♂.
- Vic of San Pedro, 900 m. a. s. l. Pools and ponds May 15-19, 1935, F. Woytkowski. 1 apterous ♀.
- Roqueron del Padre, Abad Cordulern, Azut Dept. Loreto. 1 apterous ♂.
- Dept. Ayacucho Prov. La Mar. Sivia jungle 790 m. a. s. l. Brooks, June 24-30, 1941, F. Woytkowski. No. 425. 2 apterous ♀ ♀, 1 winged ♀.
- Dept. Ayacucho Prov. La Mar Sivia jungle 790 m. a. s. l. Stagnant pools, June 24-30, 1941, F. Woytkowski. No. 426. 1 apterous ♂, 3 apterous ♀ ♀.
- Dept. Ayacucho Prov. La Mar Sivia, Jungle 790 m. a. s. l. Stagnant boggy pools, June 18-19, 1941, F. Woytkowski. No. 428. 5 apterous ♂ ♂, 6 apterous ♀ ♀, 1 winged ♀.
- Dept. Ayacucho Prov. La Mar Sivia jungle 790 m. a. s. l. Slow flowing brooks, June 16, 1941, F. Woytkowski. No. 429. 11 apterous ♂ ♂, 1 winged ♂, 10 apterous ♀ ♀.
- Satipo, XII, '42, Pedro Paprzycki. 1 apterous ♂, 6 apterous ♀ ♀.
- Satipo, Nov. 1942, Pedro Paprzycki. 4 apterous ♂ ♂, 11 apterous ♀ ♀.
- Satipo, VII '42 and VI '42, Pedro Paprzycki. 33 apterous ♂ ♂, 35 apterous ♀ ♀.

*Rhagovelia imitatrix* n. sp.

(Fig. 3)

Size:	Length	Width
	3.40 mm. apterous ♂	1.26 mm. apterous ♂
	4.06 mm. apterous ♀	1.70 mm. apterous ♀
	3.80 mm. winged ♂	1.66 mm. winged ♂
	4.32 mm. winged ♀	1.73 mm. winged ♀

**Color:** General color black, clothed with very fine gray-brown pubescence. Head with usual impressed lines well defined. Pronotum with

anterior half gray with a median orange area. Venter blue-gray; last abdominal segment and genital segments black. Base of first antennal segment, anterior and posterior acetabulae, base of femora, and all coxae yellow. Occasionally a small, shining, black spot on dorsum of last abdominal segment. Winged forms slightly darker than apterous forms; wings dark brown.

**Structural Characteristics:** Fusiform. Usual long hairs and setae present. Pronotum sutured off from mesonotum in apterous forms. **Apterous male:** anterior trochanter unarmed. Anterior tibia sinuate; slightly flattened at the apex. Pronotum much wider than long (L. 16, W. 75); mesonotum truncate (L. 80, W. 75) nearly reaching to the posterior border of the metanotum. Proportions of antennae: Seg. I: II: III: IV:: 80: 48: 48: 41; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 185: 125: 70: 60; of posterior legs: 125: 180: 10: 22. Angle of taper of abdomen increasing on last three segments. Venter of last abdominal segment with depression on each side of a median ridge. Posterior trochanter unarmed. Posterior femur not incrassate (L. 125, W. 20) and unarmed. Posterior tibia extremely elongate, straight and not armed. **Apterous female:** proportions of antennae: 77: 45: 45: 40; of intermediate legs: 187: 123: 64: 62; of posterior legs: 129: 168: 10: 27. Posterior trochanter, femur, and tibia the same as in the male. **Winged forms:** proportions of legs and antennae similar to apterous forms. Posterior femur as in apterous forms. Humeri prominent. Wings extending well beyond apex of abdomen. Venter with last segment as in apterous forms. Pronotum not produced into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; allomorphotype, winged ♀; paratypes, 88 apterous ♂♂, 127 apterous ♀♀; paramorphotypes, 1 winged ♂, 1 winged ♀. Described from specimens labeled: "Peru, S. A. Sept. 6-1937. F. Woytkowski. No. 3784. Dept. of Huanuco. Vic. of Huanuco Andes 2000 m. a. s. l. In streamlet." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near *Rhagovelia longipes* Gould from which it differs in the proportions of the antennae and the male claspers which are broad and shovel-shaped rather than narrowed toward the apex as in *R. longipes*.

#### **Data on Distribution:**

Peru, S. A.: Dept. of Huanuco Vic. of Huanuco Andes, 2000 m. a. s. l. In streamlet Sept. 6, 1937, F. Woytkowski. No. 3784 (type series) 89 apterous ♂♂, 2 winged ♂♂, 128 apterous ♀♀, 2 winged ♀♀.  
Dept. of Huanuco, Vic. Huanuco Rio Huallaga, Subtropical, May 24, 1937, F. Woytkowski. No. 3770. 1 apterous ♂.  
Dept. of Huanuco, Vic. Leonpampa Jungle 800 m. a. s. l. Forest pools. Dec. 11, 1937, F. Woytkowski. No. 387. 2 apterous ♂♂, 7 apterous ♀♀.  
Rio Paucartambo, Bot 1934 of Gertrude E. Nelson. 37 apterous ♂♂, 59 apterous ♀♀.

*Rhagovelia jubata* n. sp.

( Fig. 5)

Size:	Length	Width
	4.55 mm. apterous ♂	1.49 mm. apterous ♂
	4.53 mm. apterous ♀	1.52 mm. apterous ♀
	4.72 mm. winged ♀	1.66 mm. winged ♀

**Color:** General color red-brown, clothed with a golden pubescence. Pronotum with yellow band on anterior portion, the sides of this band becoming silvery behind the eyes. Pronotum slightly lighter in shade than the metanotum. Venter dark gray. Venter of last abdominal segment and genital segments of male brown with median yellow area. Basal portion of first antennal segments, all coxae, bases of anterior and posterior trochanters, bases of anterior and posterior femora yellow. In addition the anterior femur is marked with a yellow line running the full length of the ventral surface, also the posterior femur is conspicuously striped with the anterior and posterior-ventral surfaces yellow for their full length. The dorsum of the fifth abdominal segment of female darker than other abdominal segments.

**Structural Characteristics:** **Apterous male:** anterior trochanters unarmed, and pronotum wider than long (L. 68, W. 85); metanotum very much wider than long (L. 10, W. 95). Proportions of antennae: Seg. I: II: III: IV:: 84: 47: 44: 42; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 175: 130: 48: 64; of posterior legs: 152: 136: 8: 26. Abdomen tapering evenly posteriorly. Dorsum with scattered long hairs. Venter with median carina thickly beset with long hairs; ventral carina extending to the last abdominal segment. Posterior trochanter armed with one to several very short, and one to three longer teeth. Posterior femur greatly incrassate (L. 150, W. 50); armed on basal third with a row of very small teeth ending in a long spine, followed by two irregular rows of about seven smaller spines to the apex. Posterior tibia slightly sinuate, armed on its ventral surface with subequal teeth except for the apical tooth which is elongate and apposable to the longer teeth on the trochanter; a long spur is present at the apex of the tibia. **Apterous female:** pronotal proportions same as in male. Abdomen gradually tapering posteriorly. Antennal proportions: 75: 45: 43: 39; proportions of intermediate legs: 155: 111: 46: 64; of posterior legs: 135: 117: 8: 26. Posterior trochanter unarmed; posterior femur moderately incrassate (L. 135, W. 35) and armed with from none to four very small teeth and one small spine on basal third, then at the middle with one large spine and two irregular rows of approximately seven smaller spines to the apex. Posterior tibia very slightly sinuate, and armed with equal teeth and an elongate spine at apex. **Winged female:** proportions and armature similar to apterous female. Apex of pronotum beset with long dark hairs; not produced into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; allomorphotype, winged ♀; paratypes, 40 apterous ♂♂, 24 apterous ♀♀. Described

from specimens from Aguaítia Dept. Loreto, Peru, S. A. Collected by F. Woytkowski, Sept. 1, 1946. All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is perhaps closest to *Rhagovelia robusta* Gould from which it can be easily separated by the armature of the posterior femur and the lack of the stout tooth near the apex of the posterior tibia, which in *R. robusta* is followed by one or two smaller denticulations before the apex.

**Data on Distribution:**

Peru: Aguaítia Dept. Loreto Peru, S. A. IX, 1946, F. Woytkowski. (Type series). 41 apterous ♂♂, 25 apterous ♀♀, 1 winged ♀, 2 nymphs.  
 Aguaítia Dept. de Loreto, IX, 1946. F. Woytkowski. 17 apterous ♂♂, 13 apterous ♀♀, 2 nymphs

***Rhagovelia nitida* n. sp.**

(Fig. 7)

Size:	Length	Width
	4.39 mm. apterous ♂	1.49 mm. apterous ♂
	4.39 mm. apterous ♀	1.49 mm. apterous ♀
	4.52 mm. winged ♂	1.82 mm. winged ♂
	4.62 mm. winged ♀	1.80 mm. winged ♀

**Color:** General color brown, with prominent yellow markings, covered with a very short golden pubescence. Pronotum tan with uninterrupted yellow band on anterior quarter; slightly lighter line running longitudinally down middle of pronotum. Metanotum and dorsum of first abdominal segment darker than pronotum. Remainder of dorsum of abdomen tan to yellow with narrow darker areas at juncture of each of the segments. Venter, antennae, and genital segments practically unicolorous; legs slightly darker. Posterior femur slightly lighter at base and for three-fourths its length ventrally. Wings red-brown; veins darker, not prominent.

**Structural Characteristics:** **Apterous male:** anterior trochanter unarmed. Anterior tibia not dilate, very slightly excavate on apical third. Pronotum wider than long (L. 75, W. 90); metanotum very much wider than long (L. 10, W. 94). Proportions of antennae: Seg. I. II: III: IV:: 77: 49: 52: 44; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 150: 117: 45: 60; of posterior legs: 150: 163: 15: 30. Connexiva tapering sharply for the last three segments. Ventral carina sharply elevated between coxae of posterior legs with a depression on each side, becoming evanescent on fourth segment. Posterior trochanter thickly beset with long hairs; unarmed. Posterior femur greatly incrassate (L. 150, W. 57); ventral surface flattened and beset on basal third with long hairs. Armed on basal half with three very irregular rows of dark teeth and one long stout isolated spine on posterior margin of the ventral surface of leg slightly beyond basal third. Armed on apical half of femur with approximately six small, stout spines set in two irregular rows. Posterior tibia slightly sinuate and armed within with two rows of black teeth, the teeth at the apical three-fourths tending to

be slightly enlarged; armed at the apex with a brown spur. **Apterous female:** anterior tibia formed as in apterous male. Pronotum wider than long (L. 70, W. 90); metanotum much wider than long (L. 7, W. 92). Proportions of antennae: 70: 44: 45: 43; of intermediate legs: 130: 108: 42: 58; of posterior legs: 112: 147: 11: 26. Posterior trochanter unarmed. Posterior femur only moderately incrassate (L. 112, W. 25) and armed on the apical third with a small spine followed by three decreasing spines to the apex. Posterior tibia apparently unarmed. **Winged forms:** proportions and armature similar to the apterous forms. Pronotum not produced into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; allomorphotype, winged ♀; paratypes 4 apterous ♂♂, 3 apterous ♀♀; paramorphotypes, 3 winged ♀♀. Described from a series of specimens labeled: "B. W. I., Jamaica, St. Thomas Rd. to Corn Puss Gap, Aug. 1941. C. B. Lewis." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near *Rhagovelia jubata* n. sp. from which it can be separated by the armature of the posterior femur. The male clasper is also distinct.

**Data on Distribution:**

- Jamaica, B. W. I.: St. Thomas Rd. to Corn Puss Gap, Aug. 1941, C. B. Lewis. (Type Series). 5 apterous ♂♂, 1 winged ♂, 4 apterous ♀♀, 4 winged ♀♀.
- St. Andrew Shooters Hill, e. 1800 ft. 3-XII-46. G. B. Thompson. 1 winged ♀.
- St. Thomas, XI-14-46. G. B. Thompson. 2 apterous ♂♂, 1 apterous ♀, 4 nymphs.
- St. Andreas, IV-17-47. G. B. Thompson. 7 apterous ♂♂, 8 apterous ♀♀, 15 nymphs.

***Rhagovelia ornata* n. sp.**

(Fig. 9)

Size:	Length	Width
	5.98 mm. apterous ♂	1.63 mm. apterous ♂
	6.00 mm. apterous ♀	1.63 mm. apterous ♀

**Color:** General color red-brown; practically unicolorous. Last two segments of antennae and last tarsal segments of intermediate legs darker brown. Pronotum without lighter band at anterior margin.

**Structural Characteristics:** **Apterous male:** anterior trochanters unarmed. Anterior tibiae not dilate, slightly excavate on apical fifth. Pronotum wider than long (L. 90, W. 103); metanotum much wider than long (L. 11, W. 115). Proportions of antennae: Seg. I: II: III: IV:: 107: 55: 56: 55; of intermediate legs: Fem.: Tib.: Tars. II.: Tars. III.: 200: 150: 62: 75; of posterior legs: 192: 178: 41: 20. Connexiva tapering very slightly until last two segments. Ventral carina pronounced between the posterior coxae where the segment is depressed on each side, becoming evanescent on the next

to the last segment. Posterior trochanter armed with approximately twelve small, knob-like teeth. Posterior femur greatly incrassate (L. 192, W. 62) on most specimens; armed on basal half with a single row of approximately eighteen equally spaced spines which are graduated in size from small teeth on basal area to small spines at the middle. The apical half of the femur is armed with one isolated larger spine on the posterior margin at the apical third, also with two smaller rows of spines, the posterior row consisting of seven spines and the anterior row of six spines decreasing in size to the apex. None of the spines of the posterior femur are greatly enlarged. The posterior tibia is sinuate and recurved beyond apical third; armed with a double row of small teeth with a stout spine at apical third followed by two slightly enlarged teeth, and a stout spur at apex. **Apterous female:** anterior tibiae not dilate, slightly excavate on apical fourth. Proportions of antennae: 100: 51: 55: 50; of intermediate legs: 185: 140: 57: 73; of posterior legs: 160: 176: 18: 36. Abdomen with only a very slight taper from base to apex. Ventral carina distinct on basal segments, becoming evanescent on last three abdominal segments. Posterior trochanter armed with approximately two small, dark teeth. Posterior femur only slightly incrassate (L. 160, W. 30) and armed at the apical third with one small spine followed by four smaller spines to apex. Posterior tibia straight and armed on basal half with a few small teeth and with a spur at apex. **Winged forms:** unknown.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; paratypes, 32 apterous ♂♂, 59 apterous ♀♀. Described from series labeled: "Bolivia, S. A., Miguelito, May, 1938, A. M. Olalla." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near to *Rhagovelia crassipes* Champion from which it can be separated by the armature of the posterior femur and tibia. The male clasper is also quite distinct.

**Data on Distribution:**

Bolivia, S. A.: Miguelito, May, 1938. A. M. Olalla. (Type series). 33 apterous ♂♂, 60 apterous ♀♀.

***Rhagovelia perfidiosa*, n. sp.**

(Fig. 10)

Size:	Length	Width
	2.98 mm. apterous ♂	1.16 mm. apterous ♂
	3.32 mm. apterous ♀	1.33 mm. apterous ♀
	3.52 mm. winged ♂	1.46 mm. winged ♂
	3.53 mm. winged ♀	1.50 mm. winged ♀

**Color:** General color brown, clothed with a golden pubescence. Pronotum with yellow band on anterior fifth, becoming silver behind the eyes. Mesonotum light brown with a median line and posterior margin yellow to tan. Dorsum of first abdominal segment blue-gray except for median brown area; fourth and fifth abdominal segments blue-gray with smaller median dark brown areas; sixth abdominal segment brown with yellow median area,

seventh abdominal segment and genital segments yellow. Venter blue-gray. Venter of last abdominal segment and genital segments yellow. Base of antennae, all acetabulae, coxae, trochanters, base of anterior and posterior femora, and total length of dorsal and ventral surfaces of intermediate and posterior femora yellow. Connexiva broadly yellow. Basal half of wings lighter than apical half.

**Structural Characteristics:** **Apterous male:** anterior trochanters unarmed. Anterior tibiae slightly dilate, excavate on apical two-fifths. Pronotum wider than long (L. 50, W. 67); metanotum much wider than long (L. 7, W. 57). Proportions of antennae: Seg. I: II: III: IV:: 50: 29: 29: 30; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 110: 80: 29: 47; of posterior legs: 88: 78: 4: 18. Abdomen tapering more sharply to apex on last three segments. Venter without median carina. Posterior trochanter armed with from one to nine very small knob-like teeth with one larger tooth near apex. Posterior femur greatly incrassate (L. 88, W. 30). Armed on basal third with a row of very small teeth; after the basal third with two irregular rows of spines. The anterior row of spines begins at the basal third with one long spine followed by three smaller spines which are followed by another long spine offset toward the anterior margin and three smaller spines to apex. The posterior row begins approximately at the middle with one large spine followed by four decreasing spines to apex. Posterior tibia slightly sinuate and armed with a double row of equal teeth throughout; armed at the apex with a long, stout spur. **Apterous female:** proportions of antennae: 55: 28: 30: 30; of intermediate legs: 110: 83: 34: 51; of posterior legs: 92: 80: 5: 22. Abdomen tapering evenly to apex. No median ventral carina. Posterior trochanter unarmed. Posterior femur greatly incrassate (L. 92, W. 30) and armed just before the middle with a long spine followed by approximately five smaller spines to apex. There is also a row of four small spines on the anterior margin of the ventral surface beginning at the apical third and continuing to apex. Posterior tibia slightly sinuate and armed with a double row of teeth that decrease in size to the apex; the apex is armed with a long, stout spur. **Winged forms:** proportion and armature same as for apterous forms. Apex of pronotum thickly beset with long, dark hairs; not continued into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; allomorphotype, winged ♀; paratypes, 81 apterous ♂♂, 85 apterous ♀♀; paramorphotypes, 5 winged ♂♂, 14 winged ♀♀. Described from series labeled: "Brazil, S. A.: A. M. Olalla, No. 379." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species is near *Rhagovelia amazonensis* Gould but can be easily separated by the armature of the posterior femur and by the male claspers which are quite distinct.

**Data on Distribution:**

Brazil, S. A.: A. M. Olalla, No. 379. 82 apterous ♂♂, 6 winged ♂♂, 86 apterous ♀♀, 15 winged ♀♀. (Type series).

Rio Negro Manaos Region, Oct. 1935. A. M. Olalla. 3 apterous ♂♂, 2 winged ♂♂, 7 apterous ♀♀.

Rio Purus Castanha Region, Sept. 1935. A. M. Olalla. 1 winged ♀.

Vic Joao Pesson, (Sao Phelipe) River Jurua, 7-10, 9-20-36, A. M. Olalla. No. 375. 21 apterous ♂♂, 1 winged ♂, 24 apterous ♀♀, 2 winged ♀♀.

State of Para Lago Grande, Feb., '39, A. M. Olalla. 19 apterous ♂♂, 27 apterous ♀♀.

*Rhagovelia torquata* n. sp.

(Fig. 11)

Size:	Length	Width
	3.40 mm. apterous ♂	1.33 mm. apterous ♂
	3.84 mm. apterous ♀	1.37 mm. apterous ♀

**Color:** General color black, covered with a golden pubescence. Anterior quarter of pronotum gray behind eyes with median yellow area. Venter very dark gray. Base of first segment of antennae, all coxae, anterior and posterior trochanters and basal half of anterior femora yellow.

**Structural Characteristics:** Pronotum in apterous forms abbreviated, rounded behind and exposing much of mesonotum. **Apterous male:** anterior trochanters unarmed; anterior tibiae only slightly dilate and not excavate. Pronotum short (L. 32, W. 72); mesonotum longer than pronotum and truncate at apex (L. 35, W. 66); mesonotum surrounded laterally by metanotum (L. 8, W. 82). Proportions of antennae: Seg. I: II: III: IV:: 66: 42: 39: 40; of intermediate legs Fem.: Tib.: Tars. II: Tars. III:: 148: 105: 46: 57; of posterior legs: 130: 107: 7: 20. Abdomen tapering to apex, angle of taper increasing for last three segments. Slight ventral carina extending to last abdominal segment. Posterior trochanter unarmed. Posterior femur moderately incrassate (L. 130, W. 33) and armed on basal third with a row of several small teeth; just after basal third with a long, black spine followed by seven shorter spines to apex. Posterior tibia slightly sinuate and armed on basal two-thirds with a double row of closely-set, subequal teeth, on apical third with smaller, wide-spaced teeth, armed at apex with a stout spur. Posterior femora extending well beyond apex of abdomen. **Apterous female:** anterior tibiae formed as in apterous male. Pronotum slightly longer than in male (L. 40, W. 75); mesonotum truncate (L. 30, W. 80), metanotum formed as in male (L. 8, W. 83). Proportions of antennae: 65: 38: 37: 37; of intermediate legs: 135: 75: 43: 54; of posterior legs: 115: 95: 7: 20. Abdomen tapering as in male. Posterior trochanter unarmed. Posterior femur not as incrassate as in male (L. 115, W. 25) and armed before the middle with a long spine followed by five smaller decreasing spines to apex. Posterior tibia armed on basal half with a double row of closely set teeth, apparently unarmed on apical half except for a stout spur at apex. **Winged forms:** unknown.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; paratypes, 1 apterous ♂, 1 apterous ♀. Described from series labeled: "Peru, S. A. Dept. Huanuco Vic. of Afilador, Shady Jungle, 670 m. a. s. l. June 12-30, 1937. F. Woytkowski. No. 3766." All type specimens are in the Francis Hunting-



ton Snow Entomological Collections.

**Comparative Notes:** This species is close to *Rhagovelia abrupta* Gould from which it can be separated by the fact that the claspers do not project posteriorly beyond the genital segments. It is also near *Rhagovelia vivata* n. sp. but can be separated by the lack of teeth on the posterior trochanter. The male clasper is distinct and readily separates it from either of the above mentioned forms.

**Data on Distribution:**

Peru, S. A.: Dept. Huanuco Vic of Afilador, Shady Jungle 670 m. a. s. l. June 10-30, 1937, F. Woytkowski. No. 3766. (Type series). 2 apterous ♂ ♂, 2 apterous ♀ ♀.

Dept. Huanuco Vic Afilador, Jungle Brooks, 800 m. a. s. l. June 4, 1937, F. Woytkowski. No. 3771. 3 apterous ♂ ♂, 1 apterous ♀.

Dept. Huanuco Vic Afilador, Jungle Brooks, 800 m. a. s. l. June 8-9, 1937, F. Woytkowski. No. 3767. 1 apterous ♂.

*Rhagovelia trepida* n. sp.

(Fig. 4)

Size:	Length	Width
	3.72 mm. apterous ♂	1.33 mm. apterous ♂
	3.78 mm. apterous ♀	1.33 mm. apterous ♀

**Color:** General color brown, covered with golden pubescence. Pronotum with anterior half, and lateral and posterior margins yellow. Margins of connexiva broadly yellow. Venter blue-gray. Venter of last abdominal segment with the exception of a narrow median line, and genital segments yellow. Base of antennae, all trochanters, all coxae, bases of anterior and posterior femora yellow. The posterior femora are yellow with the exception of a prominent brown stripe on the dorso-posterior surface.

**Structural Characteristics:** Pronotum in apterous forms abbreviated and rounded behind, not covering mesonotum. **Apterous male:** anterior trochanter unarmed; anterior tibia not dilate, and only slightly excavate on apical half. Pronotum abbreviated (L. 33, W. 70), exposing much of mesonotum; mesonotum truncate (L. 26. W. 73) and not covering metanotum. Metanotum very narrow (L. 6, W. 85). Proportions of antennae: Seg. I: II: III: IV:: 57: 30: 37: 34; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 123: 96: 40: 50; of posterior legs: 106: 88: 7: 20. Angle of taper of abdomen increasing on last three segments. Slight ventral carina extending the complete length of the abdomen. Posterior trochanter unarmed. Posterior femur greatly incrassate (L. 106, W. 38) and armed on basal half with a row of very small teeth followed at approximately the middle by a larger spine and nine smaller, closely set spines to the apex. Also armed with a short anterior row of very small teeth running from apical third to apex. Posterior tibia slightly sinuate and armed with closely set teeth throughout, with the tooth at approximately the apical fifth enlarged into a small spur; also armed with a spur at apex. **Apterous female:** pronotum formed as in male (L. 37, W. 80), mesonotum as in male (L. 27, W. 85); metanotum as in male (L. 7, W. 90). Proportions of antennae: 55: 34: 39: 34; of intermediate

legs: 123: 95: 39: 52; of posterior legs: 98: 95: 9: 23. Abdomen tapering to apex. Venter without median carina. Posterior trochanter unarmed. Posterior femur not as incrassate as in the male (L. 98, W. 21) and armed on basal half with one small tooth or may be unarmed on basal half; apical half armed with one long spine just beyond the middle followed by three to five smaller, rapidly decreasing teeth to apex. Posterior tibia straight and apparently unarmed except for a small spur at apex. **Winged forms:** unknown.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; paratypes, 36 apterous ♂♂, 23 apterous ♀♀. Described from specimens labeled: "Sao Paulo, Brazil. XI-17-1935, Nat. Sci. Mus., Via A. M. Olalla." All type specimens are in the Francis Huntington Snow Entomological Collections.

**Comparative Notes:** This species belongs in the group of *Rhagovelia* with *R. abrupta* Gould because of its pronotal proportions. The armature of the posterior femur, and the distinctive male clasper will serve to separate it from *R. abrupta*.

**Data on Distribution:**

Brazil, S. A.: Sao Paulo Nov. 17, 1935, Nat. Sci. Mus., Via A. M. Olalla. (Type series). 37 apterous ♂♂, 24 apterous ♀♀.

***Rhagovelia vivata* n. sp.**

(Figs. 12, 12A)

Size:	Length	Width
	3.67 mm. apterous ♂	1.39 mm. apterous ♂
	4.05 mm. apterous ♀	1.46 mm. apterous ♀
	4.78 mm. winged ♂	1.59 mm. winged ♂
	4.45 mm. winged ♀	1.45 mm. winged ♀

**Color:** General color black, covered with a golden pubescence. Anterior portion of pronotum yellow becoming silvery behind the eyes. Venter dark gray; last abdominal segment black. Base of antennae, all coxae, anterior and posterior trochanters, bases of anterior femora yellow. Wings brown, slightly lighter in color at base.

**Structural Characteristics:** Pronotum abbreviated and rounded behind in apterous forms, exposing much of mesonotum. Anterior tibiae only slightly dilate, flattened on apical third. **Apterous male:** anterior trochanter unarmed. Pronotum short (L. 27, W. 76); mesonotum truncate at apex and longer than pronotum (L. 40, W. 70); metanotum much wider than long (L. 10, W. 80). Proportions of antennae: Seg. I: II. III: IV:: 68: 38: 38: 40; of intermediate legs: Fem.: Tib.: Tars. II: Tars. III:: 148: 110: 52: 60; of posterior legs: 130: 104: 9: 26. Angle of taper of abdomen increasing on the last two segments. Abdomen with ventral carina extending to the last segment; venter of last abdominal segment with slight median depression so as to form an indistinct longitudinal trough. Posterior trochanter armed with from five to eight small, dark teeth. Posterior femur greatly incrassate (L. 130, W. 48); slightly flattened on ventral surface. Armed with two widely separated rows of spines. The anterior row, beginning at base and extending to apical third, consists of approximately nine very small spines. The

posterior row begins on basal third with a dense cluster of small, subequal teeth followed by a long, black spine and seven smaller, decreasing spines to apex. Posterior tibia slightly sinuate and armed with closely set, irregularly placed teeth, and a stout spur at the apex. **Apterous female:** pronotum formed as in male (L. 30, W. 75); mesonotum as in male (L. 41, W. 76); metanotum also as in male (L. 9, W. 90). Proportions of antennae: 67: 40: 38: 37; of intermediate legs: 142: 105: 48: 60; of posterior legs: 117: 95: 8: 24. Abdomen tapering evenly to apex. Venter without median carina. Posterior trochanter unarmed. Posterior femur not as incrassate as in the male (L. 117, W. 28) and armed before the middle with a long spine followed by six decreasing spines to apex. Posterior tibia very slightly sinuate; armed on basal half with a double row of small, subequal teeth, the apical half armed only with the stout spur at apex. **Winged forms:** proportions and armature same as for apterous forms. Wings extend well beyond apex of abdomen. Pronotum not prolonged into a spiniform process.

**Data on Types:** Holotype, apterous ♂; allotype, apterous ♀; holomorphotype, winged ♂; allomorphotype, winged ♀; paratypes, 1 apterous ♂, 3 apterous ♀♀; paramorphotypes, 1 winged ♂, 2 winged ♀♀. Described from series labeled: "Satipo, Peru, S. A., XII, '42, Pedro Paprzycki." All type specimens are in the Francis Huntington Snow Entomological Collections

**Comparative Notes:** This species belongs in the group with *Rhagovelia abrupta* Gould which has the pronotum abbreviated and rounded behind. It is perhaps closest to *Rhagovelia torquata* n. sp. from which it can be separated by the armature of the posterior femur. The male clasper is very distinctive and readily separates it from all other *Rhagovelia*.

#### Data on Distribution:

Peru, S. A.: Satipo XII-42 Pedro Paprzycki. (Type series). 2 apterous ♂♂, 2 winged ♂♂, 4 apterous ♀♀, 3 winged ♀♀.

Dept. Ayacucho Prov. La Mar Sivia Jungle, 790 m. a. s. l. Bks. Apurimac Riv., June 15-28, 1941, F. Woytkowski. No. 4212. 3 apterous ♂♂, 5 apterous ♀♀.

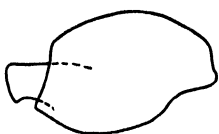
Vic Sani Beni, 840 m. a. s. l. Brooks and pools of Sani Beni, Aug. 31, 1935, F. Woytkowski. Field Note 3560. 6 apterous ♂♂, 4 apterous ♀♀.

Vic of San Pedro, 900 m. a. s. l. Jungle pools, May, 15-29, 1935, F. Woytkowski. 4 apterous ♂♂.

Satipo, Nov. 1942. Pedro Paprzycki. 2 apterous ♂♂, 1 winged ♂, 1 apterous ♀, 1 winged ♀.

#### EXPLANATION OF PLATE

- Fig. 1. *Rhagovelia bisignata* Bacon; right clasper, lateral view.  
 Fig. 2. *Rhagovelia fontanalis* Bacon; right clasper, lateral view.  
 Fig. 3. *Rhagovelia imitatrix* Bacon; right clasper, lateral view.  
 Fig. 4. *Rhagovelia trepida* Bacon; right clasper, lateral view.  
 Fig. 5. *Rhagovelia jubata* Bacon; right clasper, lateral view.  
 Fig. 6. *Rhagovelia evidis* Bacon; right clasper, lateral view.  
 Fig. 7. *Rhagovelia nitida* Bacon; right clasper, lateral view.  
 Fig. 8. *Rhagovelia diminuta* Bacon; right clasper, lateral view.  
 Fig. 9. *Rhagovelia ornata* Bacon; right clasper, lateral view.  
 Fig. 10. *Rhagovelia perfidiosa* Bacon; right clasper, lateral view.  
 Fig. 11. *Rhagovelia torquata* Bacon; right clasper, lateral view.  
 Fig. 12. *Rhagovelia vivata* Bacon; right clasper, lateral view.  
 Fig. 12.A. *Rhagovelia vivata* Bacon; right clasper, dorsal view.



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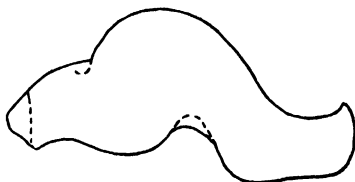
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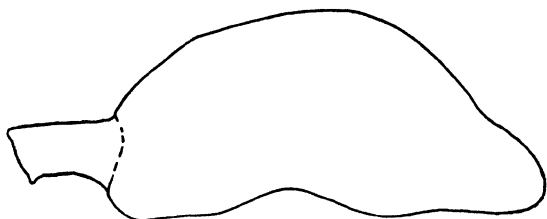
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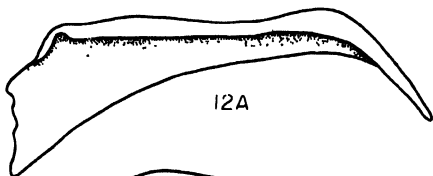
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12

## NOTES AND DESCRIPTIONS OF DORILAIIDAE

## Part II

## (Pipunculidae—Diptera)

D. ELMO HARDY

Ames, Iowa.

The writer has long realized that there is a complex of species which are closely related to *Dorilas alternatus* (Cresson). The status of *alternatus* has never been cleared up and the species has not been definitely recognized since the original description. The following notes have been prepared in an attempt to establish the identity of Cresson's species and to describe some of the related forms.

It is now quite apparent that the female specimen in Cresson's type series was not the same species as the holotype male. Homoeotypic females which were compared with Cresson's allotype by the writer have proved to be specimens of *D. loweii* (Kert). Examination of a large series of *loweii* females has failed to disclose any way of distinguishing it from the specimen which Cresson described.

Male specimens have been studied from Huachuca Mountains, Arizona, which seem to be typical *alternatus*. It has not been possible to obtain specimens from the type locality in New Mexico.

The species is very close to *D. cinctus* (Banks) but is larger in size, the antennae are very short acute, the male hypopygium is much smaller from a dorsal view and the harpagones are more rounded and slightly enlarged at apices.

The diagnostic characters are as follows: Antennae brownish black, third segment small, broadly acute (see fig. 25B\*). Third section of costa twice as long as the fourth, stigma filling all of the third section. Ultimate section of the fourth vein straight, apical cell very narrowly open at the wing margin. Crossvein r-m situated at about the basal one-fourth of the discal cell. Hypopygium very short, about one-fifth as long as the fifth segment and with a broad apical depression (fig 25C of the writer's revision). From a ventral view the coxopodite is about as wide as long. The membranous area on the eighth segment extends almost to the posterior margin of that segment. The harpagones are equal to slightly longer than the coxopodite, they are rather strongly swollen on their outer edges and rounded at their apices. The two harpagones are about equal in size and shape (fig. 1a).

Length: 3.5-4.4 mm; wings, 4.0-5.0 mm.

Female unknown.

The above notes are based upon a study of the type male from Cloudcroft, New Mexico, and upon specimens from Sunnyside Canyon, Huachuca Mts., Ariz. July 9, 1940 (D. E. Hardy). The figure shown in this paper was made from a specimen from the latter locality.

\*Hardy, 1939, Univ. of Kans. Sci. Bull., 19:203.

***Dorilas dreisbachi* n. sp.**

(Figs. 2 a,b)

This species keys out with *Dorilas alternatus* in couplet 29 of the writer's key to the genus (\*, page 58). It differs by having the third section of the costa equal to the fourth, the abdomen subshining and the genitalia much larger and differently developed.

**Male. Head:** Eyes joined on the front for a distance equal to the length of about sixteen eye facets. Front and face black in ground color, densely covered with silvery pubescence. Antennae brown, with a faint tinge of yellowish on the third segment. Third segment acute (fig. 2a), rather densely pale pubescent. Labellum yellow. **Thorax:** Mesonotum and scutellum lightly brownish pollinose, pleurae gray. Humeri black in ground color. Scutellum with very short, fine marginal hairs. Propleura apparently bare (the head obscures the prothorax on this specimen). Halteres black. **Legs:** Coxae and trochanters dark brown to blackish. Femora chiefly black, with narrow yellow apices and bases. Tibiae yellow except for broad brown to black median discolorations. Tarsi yellow brown to blackish. Hind femora brightly polished on inner sides, otherwise grayish pollinose. Flexor spines very weak and no long hairs on the femora. Hind tarsi rather strongly flattened. **Wings:** Hyaline, stigmata pale yellowish brown and filling all of the third costal sections of the wing. Third section about equal in length to the fourth, the two sections combined are one and one-half times longer than the fifth. The r-m crossvein is situated near the basal one-fourth of the discal cell and the last section of the fourth vein is straight. The apical cell is strongly narrowed in the wing margin. The last section of the fifth vein is equal in length to the m crossvein and not quite two times as long as the petiole of the cubital cell. **Abdomen:** Lightly subshining black with apices of segments faintly cinereous. First tergum all gray and with no conspicuous lateral bristles. Terga two to four broadly interrupted in the middle and lightly grayed on the sides. Fifth tergum faintly cinereous on apical margin. **Hypopygium:** Almost symmetrical from a dorsal view. About equal in length to the fifth abdominal segment and with a small but distinct apical depression and no apical keel. Sixth and seventh terga plainly visible from a dorsal view. From a ventral view the coxopodite is much longer than wide and the posterior margin has just a shallow concavity. The harpagones are very irregular, they are very broad at their bases and narrowed apically toward the inner sides. The two harpagones are rather similar in shape but the outer is more curved inward than the inner (fig. 2b).

Length: body, 4. mm.                      wings, 4.8 mm.

Female unknown.

Holotype male: Shiawassee Co., Mich., June 13, 1943 (R. R. Dreisbach).

Type returned to Mr. R. R. Dreisbach, Midland, Mich.

***Dorilas (Eudorylas) michiganensis* n. sp.**

(Figs. 3 a, b)

This species runs into couplet 27 of the writer's key but has the third section of the costa equal in length to the fourth. It differs from *alternatus* by having the ultimate section of the fourth vein sinuate, the third costal section not longer than the fourth and the abdomen not fasciated.

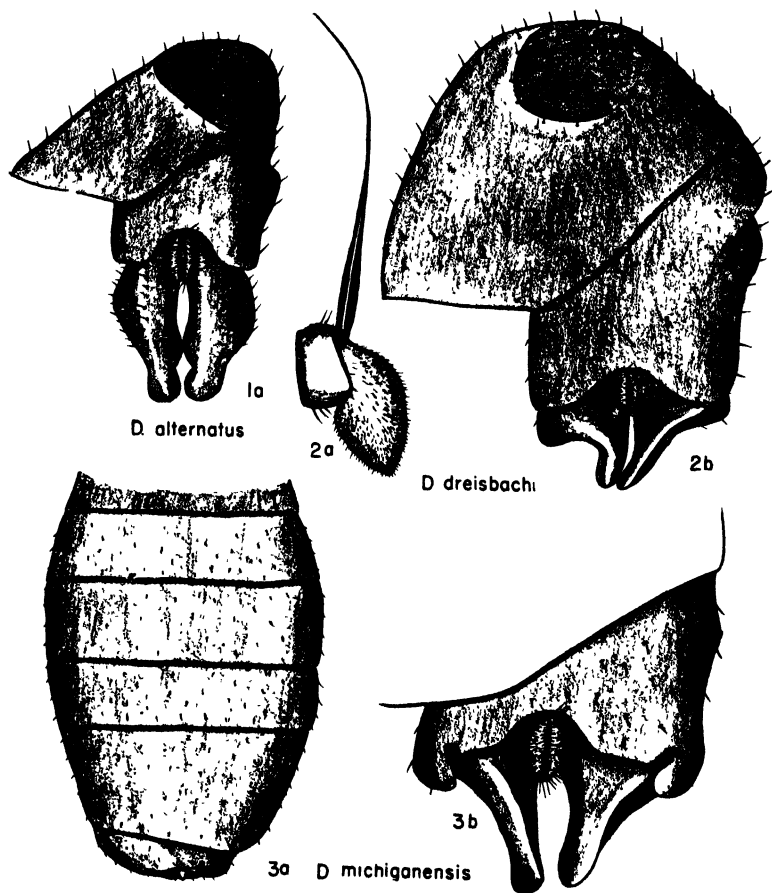
**Male. Head:** Junction of the eyes equal to the length of ten facets. Front and face densely silvery gray pubescent, lower portion of occiput gray, upper part and vertex shining black, lightly brown pollinose. Antennae dark brown, third segment acute, shaped as in *dreisbachi* n. sp. and whitish pubescent. **Thorax:** Lightly brownish pollinose on the dorsum, gray on the sides. Humeri and halteres black. Scutellum with very inconspicuous marginal hairs. Propleura bare. **Legs:** Coxae and femora black except for the narrow yellow apices of the latter. Femora gray pollinose above the black ground color, except for the polished inner surfaces of the hind pair. Tibiae chiefly black with broad yellow bases and narrow yellow apices. Tarsi yellow brown, the hind pair somewhat flattened. Flexor spines weak, all femora with a row of moderately long pale hairs running along the inner side near the top margin, these are especially well developed on the middle legs. Hind tibiae without strong hairs or bristles on the outer side. **Wings:** Hyaline, distinctly iridescent. Stigmata pale smoky brown and filling almost all of the third costal sections. Third section equal in length to the fourth, the two combined are about equal to the fifth section. Crossvein r-m situated at the basal one-third of the discal cell. Ultimate section of the fourth vein very strongly curved. Last section of the fifth vein shorter than the m crossvein and about two times longer than the petiole of the cubital cell. **Abdomen:** First tergum densely gray pollinose with four or five strong bristles in a row on each side. Remainder of abdomen subopaque, brassy black in ground color dusted with brownish pollen. Extreme lateral margins grayish. The abdomen is widest at about segments three to four and the terga are very sparsely covered with short inconspicuous hairs. **Hypopygium:** Short and rather inconspicuous from dorsal view, only about one-fourth to one-third as long as the fifth abdominal segment and with a moderately large apical membranous area and a small apical keel (fig. 3a). From a ventral view the genitalia is developed somewhat as in *dreisbachi* except that the coxopodite is broad and not so elongate, and is developed into a pair of lobes at apices. The harpagones are also differently shaped. The posterior margin of the coxopodite is rather deeply "U" shaped in the middle and the lateral margins each have a curved projection at the apex. The harpagones are shorter than the coxopodite. They are rather similar in size and shape and rounded at the apices (fig. 3b).

Length: body 4.4 mm; wings, 4.5 mm.

Female unknown.

Holotype male and one paratype male: Newago Co., Mich. July 30, 1934 (R. R. Dreisbach).

Holotype being returned to Mr. Dreisbach, paratype deposited in the U. S. National Museum collection.



#### EXPLANATION OF PLATE

- Fig. 1 *Dorillas alternatus* (Cresson) a male hypopygium, ventral view  
 Fig. 2 *D. dreisbachi* n. sp. a antenna; b male hypopygium, ventral view  
 Fig. 3. *D. michiganensis* n. sp. a male abdomen, dorsal view b male hypopygium, ventral view.



## A NEW MALLOPHAGA FROM A RUFFED GROUSE

K. C. EMERSON

Oklahoma A. and M. College, Stillwater, Oklahoma.

*Goniodes bonasus* n. sp.

(Figures 1-4)

**Female.** Head circumfasciate; clypeal margin broadly rounded with prominent angles. Temple angle with lateroventral process bearing a long seta and a short spine. Head wider than long, greatest width at the temples which are expanded.

Prothorax one-half as broad as head, with nearly straight sides that diverge from front to rear. Pterothorax triangular in shape without lateral indications of meso-metathoracic junction. Legs characteristic of genus.

**Male.** Head with clypeal margin rounded, squarish posterior to antennae. Clavus prominent with a long seta. First antennal segment enlarged and without a process; third produced distally at right angles to the fourth segment.

Prothorax and pterothorax similar to those of the female except in chaetotaxy. Abdomen more rounded than in female. Pleurites each with 3 or 4 long dorsal setae.

Genitalia with a long broad basal plate and short broad parameres; each paramere with an attached short narrow appendage which points inward at a right angle.

Holotype male from *Bonasa umbellus* ssp., collected in Ravalli Co., Montana. Allotype female from the same series. Paratypes from the same collection, and from the same host collected on Newton Ranch, Pagosa Springs, Colorado.

## Comparative Notes

This species belongs to Group i, erected by Miss Clay in her revision of the genus. The accompanying figures indicate the characteristics of the species clearly and easily separate it from others found in North America. The following key will help to separate the various species of this genus found on North American game birds.

1. Temples expanded and similar in the two sexes. . . . . 2.  
     Temples exhibiting sexual dimorphism in shape, being  
     little, or not at all, expanded in the male, and being  
     expanded to a greater extent in the female. . . . . 3.
2. The distal post-axial angle of the third antennal seg-  
     ment prolonged at right angles to the fourth segment. . . . . *ortygis*  
     The distal post-axial angle of the third antennal seg-  
     ment prolonged parallel to the fourth segment. . . . . *dispar*
3. Spinous process present on the female genital region. . . . . 4.  
     No spinous process on the female genital region. . . . . 5.
4. Paramere with an inward pointing appendage. . . . . *nebraskensis*  
     Paramere without an appendage. . . . . *cervinicornis*

5. Clypeal band narrow. **colchici**  
Clypeal band wide. 6.
6. Temples scarcely expanded in the female, being no wider than the preantennal region. **mamillatus**  
Temples expanded in the female, being wider than the preantennal region. 7.
7. Ventral spinous process on genital region extremely small; 5-6 short hairs on the margin of the vulva. **centrocerci**  
Ventral spinous process on genital region normal to large in size; 7 or more long hairs on the margin of the vulva. 8.
8. Genitalia normal in appearance. 11.  
Narrow appendage on the paramere which points inward. 9.
9. Appendages on parameres touching each other centrally. 10.  
Appendages on parameres not touching. **bonusus**
10. Clypeal band same width throughout. **lagopi**  
Clypeal band wider on front than lateral margin of the head. **corpulentus**
11. Lateral margin of vulva straight with numerous long hair bunched on distal half of lateral margin. **merriamanus**  
Lateral margin of vulva irregular with numerous long hairs along all the lateral margin. **cupido**

## HOST LIST

- Goniodes bonusus** n. sp. **Bonasa umbellus** (probably) **umbelloides** (Douglas), Gray  
Ruffed Grouse
- Goniodes centrocerci** Simon 1938—**Centrocercus urophasianus** (Bonaparte)  
Sage Hen
- Goniodes cervinicornis** Giebel 1874—**Gennaeus nycthemerus**, Silver Pheasant
- Goniodes colchici** Denny 1842—**Phasianus colchicus torquatus** Gmelin, Ring-necked Pheasant
- Goniodes corpulentus** Kellogg and Mann 1912—**Canachites canadensis osgoodi**  
Bishop, Alaska Spruce Grouse
- Goniodes cupido** Rudow 1870—**Tympanuchus cupido pinnatus** (Brewster),  
Greater Prairie Chicken
- Goniodes dispar** Burmeister 1838—**Perdix perdix perdix** (Linnaeus), European  
Partridge
- Goniodes lagopi** (Linnaeus 1758) **Lagopus lagopus albus** (Gmelin), Willow  
Ptarmigan.
- Goniodes mamillatus** Rudow 1870—**Lophortyx californica californica** Ridgway,  
Valley Quail.
- Goniodes merriamanus** Packard 1873—**Dendragapus obscurus richardsonii**  
(Douglas), Richardson's Grouse.
- Goniodes nebraskensis** Carriker 1946—**Pedioecetes phasianellus campestris**  
Ridgway, Prairie Sharp-tailed Grouse.
- Goniodes ortygis** Denny 1842—**Collinus virginianus virginianus** (Linnaeus)  
Eastern Bob-white.

A note on the identity of **Goniodes merriamanus** Packard 1873.

Packard described this species from a single male from **Dendragapus obscurus richardsonii** (Douglas), Richardson's Grouse. In 1940, Clay

described *Goniodes simoni* from *Dendragapus obscurus obscurus* (Say), Dusky Grouse.

After examining a large series of *Goniodes* from each host, the author can find no difference in the material from the two hosts. In view of Carriker's statement, it is beyond reasonable doubt that *G. simoni* Clay is a synonym of *G. merriamanus* Packard.

As Packard's type is apparently lost, I designate as neotype a female from Richardson's Grouse, *Dendragapus obscurus richardsonii* (Douglas), from Ravalli Co., Montana; and as neallotype a male from the same collection. Many neoparatypes from the same host from this collection and from Missoula Co., Montana, will be distributed to other collections.

#### Acknowledgment

Most of the material used for this study was furnished by Dr. William L. Jellison and the Rocky Mountain Laboratory, Hamilton, Montana, for which the author is grateful.

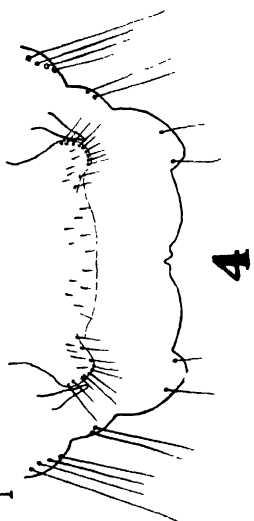
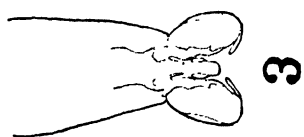
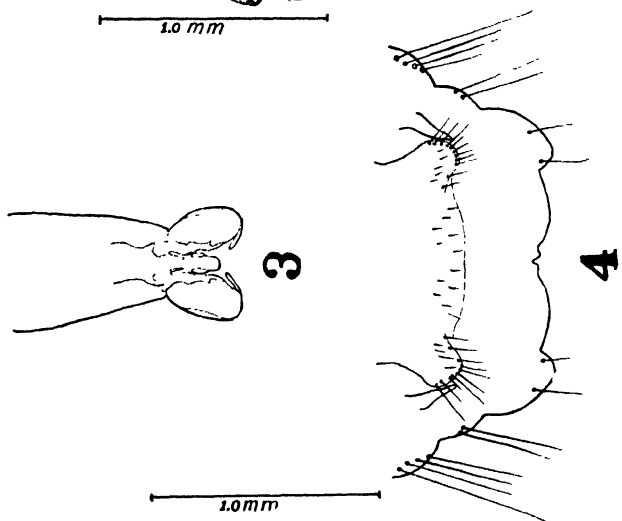
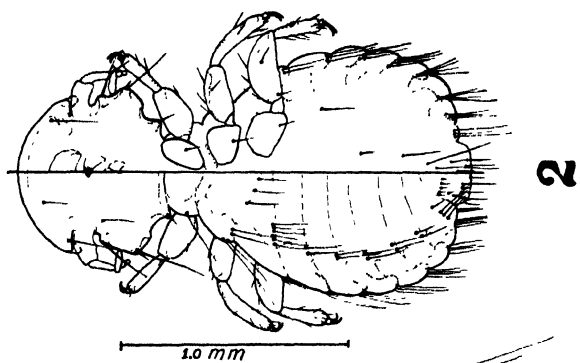
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#### EXPLANATION OF PLATE

All figures refer to *Goniodes bonasus* n. sp.:

1. Dorsal-ventral view of the female
2. Dorsal-ventral view of the male.
3. Male genitalia
4. Ventral view of the genital region of the female



## SOME NEW SPECIES OF DELPHACODES (Homoptera, Fulgoridae, Delphacinae)

### Part IV

R. H. BEAMER\*  
Lawrence, Kansas.

#### 31 *Delphacodes cornuta* n. sp.

##### Brachypterous Form:

Resembles *Delphacodes waldeni* (Metcf.) but with definite color on parts of elytra instead of just brown veins and aedeagus ending in a cornucopia-shaped apex. Length, ♂ 2.6 mm.; ♀ 2.8 mm.

**Structure:** First antennal segment about twice as long as wide; front about one-third longer than greatest width, slightly narrowed toward either end, more so toward base, strongly tricarinate; crown about as long as width between eyes; elytra slightly longer than wide, apices truncate, veins raised.

**Color:** General color brown; pronotum with three longitudinal light vittae; elytra of female with region between veins darker, in male border and claval veins lighter; abdomen in female with three more or less definite light longitudinal vittae, male with only median longitudinal stipe definite.

**Genitalia:** In lateral view pygofer much wider than long; narrowed dorsally; anal segment rectangular, widest at outer end with a pair of more or less triangular-shaped processes almost as long as segment arising at outer ventral corner; aedeagus about as long and wide as style, curved ventrally, sides almost parallel to outer third where it flares into a cornucopia-shaped, sharp apex; styles long, sides almost parallel throughout, sinuately curved with a broad tooth almost as long as width of shaft at inner apical corner; aedeagal brace about twice as wide as width of style and twice as long as own width, outer dorsal corner sharpened; in caudal view aedeagal brace scarcely projected dorsally; styles long, sinuate, aviccephaliform, beak on outside.

Holotype ♂, La Belle, Fla., March 3, 1947, R. H. Beamer; allotype ♀ and one ♂ paratype, July 7, 16, 1939, R. H. Beamer; 1 ♂ paratype, Royal Palm State Park, Fla., March 16, 1947, L. D. Beamer. Types in the Snow Entomological Collections.

#### 32. *Delphacodes quadridentis* n. sp.

##### Brachypterous Form:

Resembling *Delphacodes acuministyla* Dozier but males without brown tips to elytra and anal segment with two pairs of processes instead of one. Length ♂ 1.5 mm.; ♀ 1.8 mm.

**Structure:** First segment of antennae slightly longer than wide; front a little more than twice as long as wide, widest near apical third, considerably narrower at base than at apex, tricarinate, median carina quite heavy; crown slightly longer than wide, carinae definite; elytra almost twice as long as wide, apices rounded.

\*Contribution from the Department of Entomology, University of Kansas.

**Color:** General color of female stramineous, male with dorsum of about basal half of abdomen more or less dark brown and genital capsule except anal tube, black.

**Genitalia:** In lateral view, pygofer more or less rectangular, slightly longer on ventral margin; anal segment with two pairs of processes, one pair short and blunt, the other about three times as long as first, sharp; aedeagus narrowed near middle with margins almost parallel on outer half, dorsal margin with about seven teeth; aedeagal brace not visible; styles with sides almost parallel to slightly enlarged region just before apices; in caudal view aedeagal brace extended dorsally more than basal width, tip slightly bifid; styles rather short with avicéphaliform apices, beak short, on inner margin.

Holotype ♂, allotype ♀, 31 ♂♂ and 37 ♀♀ paratypes, Ocean Springs, Miss., March 3, 1947, R. H. Beamer; other paratypes: 5 ♂♂ and 6 ♀♀, Ocean Springs, Miss., March 3, 1947, L. D. Beamer; 9 ♂♂ and 4 ♀♀, Sanford, Fla., March 11, 1947, R. H. Beamer; 3 ♂♂ and 1 ♀, Sanford, Fla., March 11, 1947, L. D. Beamer; 7 ♂♂ and 1 ♀, Naples, Fla., March 16, 1947, R. H. Beamer; 1 ♂ and 4 ♀♀, Mims, Fla., March 18, 1947, R. H. Beamer; 1 ♂, Hilliard, Fla., March 18, 1947, R. H. Beamer; 20 ♂♂ and 14 ♀♀, Punta Gorda, Fla., March 12, 1947, R. H. Beamer; 1 ♂, Zolpho Springs, Fla., July 15, 1939, R. H. Beamer; 5 ♂♂, Hilliard, Fla., Oct. 5, 1938, P. W. Oman; 1 ♂, Zolpho Springs, Fla., June 15, 1939, P. W. Oman.

Types and paratypes in Snow Entomological Collections, paratypes in United States National Museum.

### 33. *Delphacodes aetocephala* n. sp.

#### **Brachypterous Form:**

Resembling *Delphacodes parcula* Eall bua anal segment of male with a pair of sharp processes and aedeagus in lateral view resembling the head of an eagle. Length ♂ 2.0 mm.; ♀ 2.5 mm.

**Structure:** First antennal segment slightly longer than wide, front almost twice as long as wide, widest near outer third, narrowed toward each end, more so toward base, barely more than half as wide at base as at widest place, strongly tricarinate; crown slightly longer than width at base, carinae definite; elytra semihyaline, almost twice as long as wide, apices rounded, veins raised with few long hairs.

**Color:** General color stramineous to cinereous, dorsum of abdomen more or less longitudinally lineate with darker.

**Genitalia:** In lateral view pygofer more or less rectangular, widest on venter; anal segment with pair of sharp processes; aedeagus widest at base, gently narrowed and strongly curved ventrally to sharp apex, avicéphaliform; aedeagal brace narrow extending above level of edges of pygofer; styles more or less pediform, base strongly arcuate.

Holotype ♂, allotype ♀, 63 ♂♂ and 46 ♀♀ paratypes, Covington, La., Mar. 3, 1947, R. H. Beamer; other paratypes: 45 ♂♂ and 18 ♀♀, Slidell, La., Mar. 3, 1947, R. H. Beamer; 2 ♂♂, Pearlinton, Miss., Mar. 3, 1947, R. H. Beamer; 14 ♂♂ and 8 ♀♀, Ocean Springs, Miss., Mar. 3, 1947, R. H. Beamer;

3 ♂♂ and 2 ♀♀, same place and date, L. D. Beamer; 31 ♂♂ and 9 ♀♀, Mariana, Fla., Mar. 7, 1947, R. H. Beamer; 18 ♂♂ and 8 ♀♀, same place and date, L. D. Beamer; 1 pair, Sanford, Fla., July 22, 1926, E. D. Ball.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

#### 34. *Delphacodes turgida* n. sp.

##### **Brachypterous Form:**

Resembles *Delphacodes sagae* Beamer but females, crown, pronotum and scutellum of males stramineous instead of fumous, and dorsal margin of aedeagus greatly swollen near middle. Length ♂ 3.0 mm.; ♀ 4.0 mm.

**Structure:** First antennal segment twice as long as wide; front a little more than twice as long as wide, widest near apical third, narrowed toward each end, more so toward base, distinctly tricarinate; crown about one-third longer than wide, carinae visible; elytra of male not reaching genital capsule, opaque, apices rounded, veins raised, female with elytra, exposing last three abdominal segments, apices rounded, veins heavier.

**Color:** General color stramineous; in male elytra, spot above hind coxae, more than half of abdomen and all of genital capsule except dorsum dark brown to black; female with spot above hind coxae and some longitudinal lines on abdomen more or less slightly darkened.

**Genitalia:** In lateral view, pygofer somewhat extended on caudo-dorsal corner; anal segment with a pair of long, sharp, processes extending almost directly away from segment; aedeagus narrowest at base, curved ventrally throughout, greatly swollen on dorsal margin at middle with four sharp retrorse teeth on dorsal margins between swelling and apex; aedeagal brace visible, large, more or less rectangular in shape, with outer half of ventral margin, more or less serrate; styles narrowed on outer third to sharp apices, a large tooth on this margin at outer third; in caudal view styles almost straight, narrowed on outer margin on apical third; aedeagal brace about twice as wide at base as at apex, extended dorsally more than half length of styles, apex bifid with a retrorse tooth, about as long as half width of brace at apex on either side just before tip.

Holotype ♂, allotype ♀, 10 ♂♂ paratypes, Yankeetown, Fla., Mar. 9, 1947, R. H. Beamer; other paratypes: 4 ♂♂, same place and time, L. D. Beamer; 10 ♂♂ and 9 ♀♀, Melbourne, Fla., Mar. 17, 1947, R. H. Beamer; 2 ♂♂, Woodville, Fla., Mar. 7, 1947, R. H. Beamer; 2 ♂♂, Mims, Fla., Mar. 18, 1947, R. H. Beamer; 5 ♂♂ and 2 ♀♀, Palatka, Fla., Mar. 10, 1947, R. H. Beamer; 1 ♂, Okefenokee Swamp, Ga., Bill's Island, July 27, 1929, R. H. Beamer; 1 ♂, Sanford, Fla., Aug. 16, 1926, E. D. Ball; 1 ♂, Sanford, Fla., Feb. 22, 1926, E. D. Ball; 2 ♂♂, Sanford, Fla., Nov. 23, 1926, E. D. Ball; 1 ♂ and 3 ♀♀, New Smyrna, Fla., Oct. 30, 1927.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

#### 35. *Delphacodes andromeda* n. sp.

##### **Brachypterous Form:**

Resembling *Delphacodes andromeda* (V.D.) but general color of elytra and abdomen much lighter and first pair of processes on anal segment short

and sharp-pointed instead of very wide, long, and with rounded apices. Length ♂ 1.5 mm.; ♀ 2.0 mm.

**Structure:** First segment of antenna about as broad as long; front not quite twice as long as wide, widest at middle, apex very slightly wider than base, distinctly tricarinate; crown one third longer than basal width, wider at apex than at base, carinae distinct; elytra about as wide as long, hyaline with apices rounded.

**Color:** General color stramineous, in male, front, anterior half of pronotum and all of scutellum except apex, black; abdomen more or less tinged with dark on basal half; genital capsule black except a portion of dorsum; a spot above middle and hind coxae darker; female about as in male but darker portions not jet black.

**Genitalia:** In lateral view, pygofer more or less rectangular with outer dorsal and ventral corners rounded off making posterior margin much shorter than anterior; anal segment with two pairs of processes, the first pair short and sharp, length about equal to basal width, second pair almost as long as aedeagus bent back dorsally near middle to almost touch first pair; aedeagus slightly wider at apex than at middle, bent dorsally near base, then ventrally near outer third, outer half with numerous teeth well scattered over surface; aedeagal brace not visible in lateral view; styles with rather enlarged, more or less, serrated heels, sides slightly tapered to rounded apices with well marked angular hump on outer margins before apices; in caudal view, aedeagal brace extended dorsally about basal width, tip rounded; style rather pediform on outer third, heel rather prominent on inner margins.

Holotype ♂, allotype ♀, 102 ♂♂ and 103 ♀♀ paratypes, Otter Creek, Fla., Mar. 9, 1947, R. H. Beamer; other paratypes: 3 ♂♂ and 3 ♀♀, same place and date, L. D. Beamer; 4 ♂♂, Raleigh, N. C., Oct. 16, 1938, P. W. Oman; 2 ♂♂, Hilliard, Fla., Oct. 5, 1938, P. W. Oman; 5 ♂♂, LaBelle, Fla., July 16, 1939, P. W. Oman; 8 ♂♂, Zolpho Springs, Fla., July 15, 1939, P. W. Oman; 4 ♂♂, New Port Ritchey, Fla., Oct. 7, 1938, P. W. Oman; 1 ♂, Sanford, Fla., Oct. 31, 1925, E. D. Ball.

Types and paratypes in Snow Entomological Collections and paratypes in United States National Museum.

### 36. *Delphacodes bifida* n. sp.

#### **Brachypterous Form:**

Resembles *Delphacodes campestris* (V.D.) but larger, male pronotum with dark spot back of each eye, elytra barely reaching genital capsule and anal segment with a pair of long processes. Length ♂ 2.8 mm.; ♀ 3.0 mm.

**Structure:** First segment of antennae twice as long as wide; front a little more than twice as long as wide, widest near basal third, narrowing toward either end, more so toward base, distinctly tricarinate; crown about as wide as long, carinae distinct; elytra reaching genital capsule, about twice as long as wide, semihyaline, veins raised and apices rounded.

**Color:** General color stramineous; front darkened between carinae in some specimens; pronotum with a brown spot back of each eye; scutellum



brown outside of lateral carinae; dorsum of abdomen mostly dark brown, lighter on basal segment and on genital capsule; darker spot above middle and hind coxae and below eyes; venter of abdomen of both sexes more or less embrowned.

**Genitalia:** In lateral view, pygofer more or less rectangular, wider on dorsal half than on ventral; anal segment with a pair of long, sharp processes extending more than their own width away from segment; aedeagus almost as broad as long, bifid almost half length; aedeagal brace long, triangular in shape; styles pediform in shape, heel sharp, toe narrow; in caudal view, aedeagal brace not extending dorsally; styles very small with heavy triangular bases and apices to narrowed and extended caudo-laterally.

**Holotype** ♂, Flagstaff, Ariz., Aug. 5, 1933, R. H. Beamer; **allotype** ♀, 2 ♂ and 5 ♀ paratypes, Santa Catalina Mts., Ariz., July 15, 1933, E. D. Ball; other paratypes: 2 ♂ ♂, Santa Catalina Mts., Ariz., June 29, 1933, E. D. Ball, 3 ♂ ♂, one long-winged, Santa Catalina Mts., Ariz., E. D. Ball; 3 ♂ and 3 ♀ ♀, Santa Catalina Mts., Ariz., June 29, 1933, E. D. Ball; 1 ♂, Chiricahua Mts., Ariz., July 18, 1934, E. D. Ball. There is also present 1 ♂ from Colorado and 1 ♂ from New York which seem to be this species but are not included in the type series.

Holotype and paratypes in Snow Entomological Collections; allotype and paratypes in United States National Museum.

### 37. *Delphacodes apicata* n. sp.

#### **Brachypterous Form:**

Resembling *Delphacodes campestris* (V.D.) but males without dark spot on sides of scutellum, styles pointed, and anal segment with a pair of processes. Length ♂ 2 mm.; ♀ 2.3 mm.

**Structure:** First segment of antennae slightly longer than wide; front less than twice as long as wide, widest near middle, narrowed toward each end, slightly narrower at apex, distinctly tricarinate; crown about as wide as long, carinae not distinct; elytra scarcely reaching middle of abdomen, semihyaline, veins raised, apices more or less truncate, shortest on inner margin.

**Color:** General color stramineous; male with abdomen mostly brown with a semblance of a median longitudinal light line and of a dark spot above middle and hind coxae; female much lighter with only a suggestion of darker spots on dorsum of abdomen.

**Genitalia:** In lateral view, pygofer much narrower on dorsal margin than ventral; anal segment with a pair of long sharp processes extended away from segment; aedeagus with broad base, narrowed to one third basal width near base, almost straight to apex with numerous spines on outer half; aedeagal brace almost as long and broad as length of aedeagus with posterior margin finely serrate; styles short, curved dorsally, narrowed on outer third to sharp apices; in caudal view, aedeagal brace slightly extended dorsally and greatly arched caudally; styles sinuate, narrowed greatly on outer third.

Holotype ♂, allotype ♀, 2 ♂ and 1 ♀ paratypes, San Francisco Mt., Ariz., Aug. 12, 1929, E. D. Ball; 1 ♂ paratype, same place and collector, Oct. 3, 1934.

**Macropterous Form:**

Like the brachypterous form except wings about one third longer than abdomen and general color darker which includes an embrowned scutellum except apex.

Holomorphotype ♂, Grand Canyon, Ariz., Aug. 11, 1927, R. H. Beamer; allomorphotype ♀, 3 ♂ and 2 ♀ paramorphotypes, San Francisco Mt., Ariz., Aug. 12, 1929, E. D. Ball; 2 ♂ paramorphotypes, Flagstaff, Ariz., Aug. 7, 1929, E. D. Ball.

Types and paratypes in Snow Entomological Collections and United States National Museum.

**38. *Delphacodes arcanastyla* n. sp.**

**Brachypterous Form:**

Resembles *Delphacodes bifida* Emr. but in lateral view male with a pediform-shaped aedeagus, aedeagal trace not visible and styles not pediform. Length 2.5 mm.

**Structure:** First segment of antennae not quite twice as long as wide, widest about the middle, slightly narrowed toward each end, strongly tricarinate; crown about as long as wide, carinae definite; elytra reaching to genital capsule, semihyaline, apices rounded.

**Color:** General color stramineous; coxae, large spot above each coxae, genae, area between carinae of front, anterior two thirds of pronotum outside lateral carinae, scutellum outside lateral carinae, and most of abdomen dark brown.

**Genitalia:** In lateral view, pygofer nearly circular, strongly narrowed on ventral margin; anal segment with a pair of strong, rather blunt, processes extending away from segment; aedeagus not quite as broad at base as length, strongly pediform on outer half, heel and region basad thickly set with minute teeth; aedeagal trace and styles not visible in this view; in caudal view, styles long, diverging, sides sinuate, narrowed on outer third; aedeagal trace not extended dorsally nor caudally.

Holotype ♂, Hell's Crossing, Wash., July 6-7, 1935, R. H. Beamer.

**Macropterous Form:**

Like the brachypterous form except elytra about one third longer than abdomen and general color darker, especially the scutellum which is entirely black.

Holomorphotype ♂, Midland Co., Mich., May 26, 1945, R. R. Dreisbach; allomorphotype ♀, Paley Co., Mich., June 2, 1945, R. R. Dreisbach; 2 ♂ paramorphotypes, Amery, Wis., June 10, 1917, E. D. Ball.

Types in Snow Entomological Collections, paramorphotypes in United States National Museum.

**39. *Delphacodes paransera* n. sp.**

**Brachypterous Form:**

Resembles *Delphacodes arcanastyla* but in lateral view aedeagus many

times as long as wide, not pediform; aedeagal brace visible, long and almost parallel-sided; styles enlarged at apex. Length ♂ 3 mm.

**Structure:** First antennal segment a little longer than wide; front a little more than twice as long as wide, sides almost parallel, slightly narrowed at either end, distinctly tricarinate on apical two thirds; crown about as wide as long, carinae indefinite; elytra semihyaline, veins raised, reaching to next to the last abdominal segment, apices rounded.

**Color:** General color stramineous, large spot above middle and hind coxae, genae, spot on pronotum back of each eye, sides of scutellum at least and sometimes all of scutellum and most of abdomen dark brown; arc of front between carinae sometimes slightly darkened.

**Genitalia:** In lateral view, pygofer more or less rectangular, ventral margin curved, a tooth on caudal margin near ventral corner, dorsal margin about half as long as ventral; anal segment with a pair of sharp processes extending away from segment; aedeagus long and slender, sides almost parallel, slightly enlarged near apex on dorsal margin, slightly curved ventrally on outer third, many teeth on outer half; aedeagal brace greatly extended caudally, rectangular in shape, covered with many teeth; styles sinuate, avicephaliform at apices; in caudal view, slightly projected dorsally, broad and feebly bifid; styles slender, enlarged into avicephaliform apices with beak on inner margin.

Holotype ♂ and 1 ♂ paratype, Piedmont, South Dakota, July 17, 1937, R. H. Beamer; other paratypes: 3 ♂♂, Sturgis, South Dakota, July 21-25, 1947, H. C. Severin; 2 ♂♂, The Plains, Wanakena, N. Y., Aug. 3, 1920, C. J. Drake.

Type and paratypes in Snow Entomological Collections, paratypes in United States National Museum and collection of H. C. Severin, North Dakota State College.

#### 40. *Delphacodes dentis* n. sp

##### Macropterous Form:

Resembling *Delphacodes puella* (V. D.) but pronotum without the white hind border and male anal segment with two pairs of processes instead of one. Length ♂ 3 mm.; ♀ 3.2 mm.

**Structure:** First segment of antennae twice as long as wide; front slightly more than twice as long as wide, widest near apical third, narrowed toward each end, base narrower than apex, definitely tricarinate, median carina forking before apex of crown; crown as wide as long, carinae distinct; elytra about one third longer than abdomen, semihyaline, veins darker.

**Color:** General color stramineous; venter of sternum more or less black, genae, area between frontal carinae, spot back of each eye, area of scutellum outside lateral carinae of scutellum and sometimes entire scutellum except apex, and almost entire abdomen dark brown to black.

**Genitalia:** In lateral view, pygofer more or less trapezoidal with a small tooth near dorsal third of caudal margin; anal segment with two pairs of processes, first pair very short and heavy, second pair many times longer

than wide; aedeagus widest at base, dorsal margin sinuate, two short teeth near middle of outer third; aedeagal brace visible, oval in outline; styles widest at base narrower near middle, slightly enlarged into more or less bifid apices. In caudal view, aedeagal brace narrow, extended dorsally about its own width, slightly excavated; styles widest at base, strongly constricted just beyond middle, enlarged at apices, slightly bifid.

Holotype ♂, allotype ♀, and 1 ♀ paratype, Brownsville, Texas, Dec. 27, 1945, R. H. Beamer; other paratypes: 1 ♂, Sinton, Texas, Dec. 25, 1945, R. H. Beamer; 3 ♂♂ and 4 ♀♀, McAllen, Texas, Dec. 30, 1945, R. H. Beamer.

Types in Snow Entomological Collections.

#### 41. *Delphacodes dentipennis*, n. sp

##### **Brachypterous Form:**

Resembles *Delphacodes livida* Beamer, but wings hyaline, extending to end of abdomen and pygofer of male in lateral view with a large tooth near middle of caudal margin. Length ♂ 2.2 mm.

**Structure:** First antennal segment about twice as long as wide; front about twice as long as wide, widest near middle, very slightly narrowed toward each end, slightly more so toward base, distinctly tricarinate; crown slightly longer than wide, widest at apex, carinae fairly distinct; elytra extending to tip of abdomen, hyaline, veins thickened.

**Color:** General color dark; legs, antennae, ventral margins of pronotum, tip of scutellum, basal segment of abdomen, and anal tube stramineous.

**Genitalia:** In lateral view, pygofer slightly wider than long, longest near middle with a large tooth near middle of caudal margin; anal segment very large with a pair of very long, heavy, processes; aedeagus bent ventrally near base about twice as wide near outer third as near base, narrowed at apex, dorsal third of outer half covered with teeth, the basal ones quite large; aedeagal brace not visible; styles more or less pediform, heel and toe sharp; in caudal view, aedeagal brace not extended dorsally, very broad; styles widest at base narrowed to apices with sharp tooth on inner margin near basal fourth.

Holotype ♂ and 8 ♂ paratypes in Mountain Lake, Va., Sept. 2, 1946, R. H. Beamer; other paratypes: 3 ♂♂, Storrs, Conn., Aug. 10, 1946, R. H. Beamer; 1 ♂, Colchester, Conn., Aug. 10, 1946, R. H. Beamer; 1 ♂, Rhineland, Wis., July 15, 1917, E. D. Ball.

Types and paratypes in Snow Entomological Collections, paratypes in the United States National Museum.

#### 42. *Delphacodes atralabis* n. sp.

##### **Brachypterous Form:**

Resembling *Delphacodes campestris* (V. D.) but male lacking dark spot on each side of scutellum and styles in caudal view narrowed on outer two-thirds. Length ♂ 2.2 mm.

**Structure:** First antennal segment about as long as wide; front about twice as long as wide, widest near middle, narrowed toward each end, more so toward apex, distinctly tricarinate; crown longer than wide, wider at apex than at base, carinae distinct; elytra semihyaline, extending slightly beyond middle of abdomen, apices rounded.

**Color:** General color stramineous with a large spot above middle coxae and styles black or dark brown; abdomen reddish yellow.

**Genitalia:** In lateral view, pygofer more or less rectangular, wider than long; anal segment without processes; aedeagus widest at base, narrowed on basal third to about one-third basal width, outer two-thirds evenly curved ventrally, with short tooth at apex on dorsal margin and four teeth near middle of outer third, aedeagal brace, large, triangular, apex sharp, bent somewhat ventrally; styles widest at base, narrowed to widen again just before more or less bifid apex; in caudal view, aedeagal brace not extended dorsally; styles widest at base, sharply narrowed at basal third, outer two-thirds with sides almost parallel, with small tooth on inner margin just before rounded apices.

Holotype ♂, Durham, New Hampshire, Aug. 12, 1946, L. D. Beamer; 2 ♂♂ paratypes same place and date, R. H. Beamer.

**Macropterous Form:**

Like the brachypterous form except the elytra about one-third longer than abdomen, widest at region of crossveins.

Holomorphotype ♂, Durham, New Hampshire, Aug. 12, 1946, R. H. Beamer.

Types in Snow Entomological Collections.

43. *Delphacodes arcuata* n. sp.

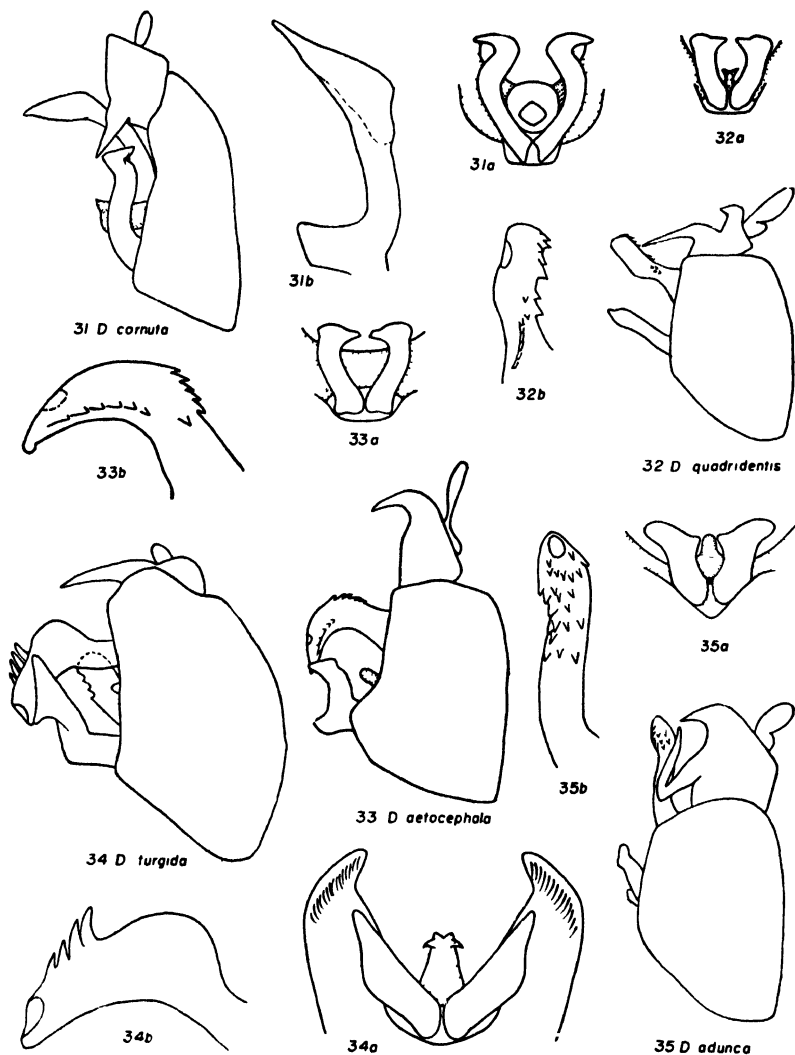
**Brachypterous Form:**

Resembling *Delphacodes quadrispinosa* M. and G. but males with posterior half of pronotum white instead of black and anal segment without processes instead of four. Length ♂ 2 mm.; ♀ 2.3 mm.

**Structure:** First segment of antennae about twice as long as wide; front slightly more than twice as long as wide, widest on apical third, slightly narrowed to apex, more so toward base, definitely tricarinate; crown longer than width at base, definitely carinate; elytra about twice as long as wide, reaching genital capsule, apices rounded, veins raised with raised spots fairly numerous.

**Color:** General color stramineous, male coxae and above, genae, clypellus. area between carinae of front and crown, small areas back of eyes, most of elytra except apical margin and spot on mesal margin before apex of clavus, most of dorsum of abdomen except basal segment, middle of last segment and anal segment and most of middle portions of ventral segments quite dark brown; females much the same but often generally much lighter.

**Genitalia:** In lateral view, pygofer more or less rectangular, widest on ventral margin, dorso-caudal corner slightly extended; anal segment without processes as such but outer dorsal corner extended slightly and outer ventral corner roundly extended; aedeagus long, generally curved dorsally, shaft slightly narrowed just before two sharp teeth on dorsal margin near outer fourth; another sharp spine on left side about opposite these; aedeagal brace not visible; styles widest on basal half, narrowed and more or less avicephaliform on apices; in caudal view, aedeagal brace extended dorsally in a more or less triangular tooth; styles broadest at base with avicephaliform apices.



#### EXPLANATION OF PLATE VII

31. Lateral view of genital capsule of male of *Delphacodes cornuta* Beamer
- 31a. Caudal view of styles and aedeagal brace of *Delphacodes cornuta* Beamer.
- 31b. Lateral view of aedeagus enlarged of *Delphacodes cornuta* Beamer.
32. Lateral view of genital capsule of male of *Delphacodes quadridentis* Beamer
- 32a. Caudal view of styles and aedeagal brace of *Delphacodes quadridentis* Beamer.
- 32b. Lateral view of aedeagus enlarged of *Delphacodes quadridentis* Beamer.
33. Lateral view of genital capsule of male of *Delphacodes actiocephala* Beamer
- 33a. Caudal view of styles and aedeagal brace of *Delphacodes actiocephala* Beamer.
- 33b. Lateral view of aedeagus enlarged of *Delphacodes actiocephala* Beamer.
34. Lateral view of genital capsule of male of *Delphacodes turgida* Beamer.
- 34a. Caudal view of styles and aedeagal brace of *Delphacodes turgida* Beamer.
- 34b. Lateral view of aedeagus enlarged of *Delphacodes turgida* Beamer
35. Lateral view of genital capsule of male of *Delphacodes adunca* Beamer.
- 35a. Caudal view of styles and aedeagal brace of *Delphacodes adunca* Beamer.
- 35b. Lateral view of aedeagus enlarged of *Delphacodes adunca* Beamer

Holotype ♂, allotype ♀, 35 ♂ and 21 ♀ paratypes, Lower Matacumba Key, Fla., March 14, 1947, R. H. Beamer.

**Macropterous Form:**

Like the brachypterous form except the wings extend about one-third their length beyond abdomen and color in elytra more spotty. A long spot at apex of clavus much darker in both forms.

Holomorphotype ♂, allomorphotype ♀, 13 ♂ and 30 ♀ paramorphotypes, Lower Matacumba Key, Fla., March 14, 1947, R. H. Beamer; other paramorphotypes: 4 ♂ ♂ and 9 ♀ ♀, Ft. Pierce, Fla., Aug. 7, 1930, R. H. Beamer; 14 ♂ ♂ and 2 ♀ ♀, same place and date, P. W. Oman; 2 ♀ ♀, Sebring, Fla., Aug. 5, 1930, P. W. Oman; 1 ♂, Haw Creek, Fla.; 1 ♀, Ft. Myers, Fla., Aug. 14, 1930, J. O. Nottingham.

Types and paratypes in Snow Entomological Collections. Paratypes in the United States National Museum.

This is the species described by Muir and Giffard as *Delphacodes albo-notata* (Crawf.), Bull. Hawaiian Sugar Planters Association, p. 36, 1924. The type of *Delphacodes albonotata* (Crawf.) No. 15938 in the United States National Museum is a brachypterous ♂ of *Perigrinus mardis* Ashm.

44. *Delphacodes aculeata* n. sp.

**Brachypterous Form:**

Resembling *Delphacodes penepuella* Beamer but first antennal segment about color of second segment (not black as in *D. penepuella*); elytra usually embrowned on most of the outer third; pygofer of male flaring and aedeagus straight. Length ♂ 1.7 mm.; ♀ 2 mm.

**Structure:** First segment of antennae about as wide as long; front about twice as long as wide, widest near apical third, narrowed toward each end, more so toward base, distinctly tricarinate; crown about one half longer than basal width, anterior fovea more or less open at base, carinae definite; elytra barely reaching genital capsule, apices rounded.

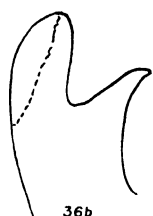
**Color:** General color dark; legs and antenna stramineous, first segment of antennae about same color as second, carinae of front and crown, posterior half of pronotum, tip of scutellum, most of clavus and margin of apices of elytra almost white, darker spot at tip of clavus, basal segment of dorsum of abdomen yellowish, margins of segments and lateral margins of abdomen usually lighter.

EXPLANATION OF PLATE VIII

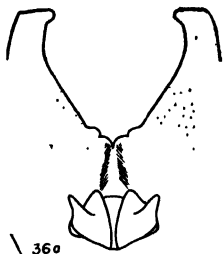
- 26 Lateral view of genital capsule of male of *Delphacodes bifida* Beamer
- 36a. Caudal view of styles and aedeagal brace of *Delphacodes bifida* Beamer.
- 36b Lateral view of aedeagus enlarged of *Delphacodes bifida* Beamer.
- 37 Lateral view of genital capsule of male of *Delphacodes apicata* Beamer.
- 37a. Caudal view of styles and aedeagal brace of *Delphacodes apicata* Beamer
- 37b Lateral view of aedeagus enlarged of *Delphacodes apicata* Beamer.
- 38 Lateral view of genital capsule of male of *Delphacodes arcanastyla* Beamer.
- 38a Caudal view of styles and aedeagal brace of *Delphacodes arcanastyla* Beamer.
- 38b Lateral view of aedeagus enlarged of *Delphacodes arcanastyla* Beamer.
- 39 Lateral view of genital capsule of male of *Delphacodes paransara* Beamer
- 39a. Caudal view of styles and aedeagal brace of *Delphacodes paransara* Beamer.
- 39b. Lateral view of aedeagus enlarged of *Delphacodes paransara* Beamer.
- 40 Lateral view of genital capsule of male of *Delphacodes dentis* Beamer.
- 40a. Caudal view of styles and aedeagal brace of *Delphacodes dentis* Beamer.
- 40b. Lateral view of aedeagus enlarged of *Delphacodes dentis* Beamer.



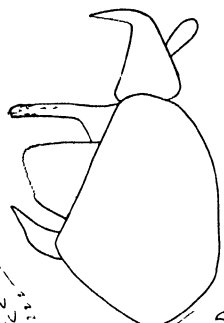
36D *bifida*



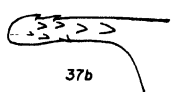
36b



36a



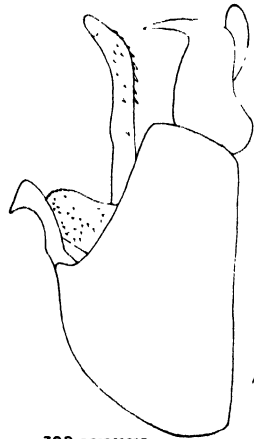
37D *apicata*



37b



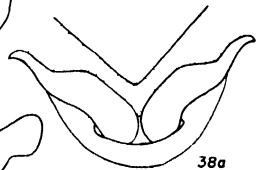
37a



39D *paransara*



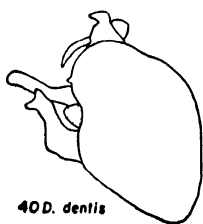
39b



38a



38b



40D. *dentis*



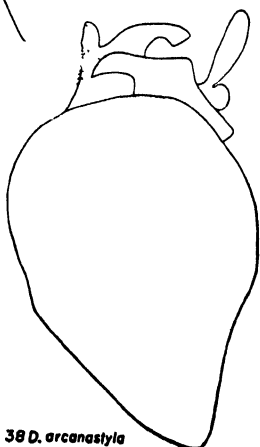
40b



39a



40a



38D. *ercanastyla*



**Genitalia:** In lateral view, pygofer semi-circular; anal segment with a pair of sharp processes, broad at base; aedeagus broadest at base, almost straight, narrowed evenly to apex, outer third evenly covered with retrorse teeth; aedeagal brace not visible in this view; styles more or less pediform, heels very large and rounded; in caudal view, aedeagal brace extended slightly dorsally, often bifid; styles broadest at base, apices more or less avicephaliform.

Holotype ♂, 6♂ and 1♀ paratypes, Otter Creek, Fla., March 9, 1947, R. H. Beamer; allotype ♀, 5♂ and 6♀ paratypes, Lamont, Fla., March 7, 1947, R. H. Beamer; other paratypes: 4♂♂, Yankeetown, Fla., March 9, 1947, L. D. Beamer.

Types in the Snow Entomological Collections.

#### 45. *Delphacodes truncata* n. sp.

##### **Brachypterous Form:**

Resembling *Delphacodes waldeni* (Metcf.) but slightly smaller, veins of elytra not so brown, tips of elytra more nearly truncate and aedeagus with dorsal margin undulating. Length ♂ 2.3 mm.; ♀ 2.8 mm.

**Structure:** First segment of antennae about twice as long as wide; front slightly less than twice as long as wide, widest at middle, narrowed toward each end, more so toward base, distinctly tricarinate; crown definitely longer than basal width, apex rounded, wider than base, carinae definite on base, less distinct at apex; elytra semihyaline, about as long as wide, apices truncate, veins raised; genital capsule very narrow, retracted into abdomen, practically flush with surface.

**Color:** General color stramineous, coxae and spot above often darker, veins of elytra slightly embrowned, semblance of longitudinal rows of spots on abdomen, darker dorsolateral margin of each abdominal segment, often with a red spot, pygofer with parts much darker.

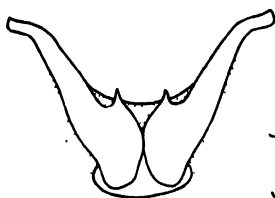
**Genitalia:** In lateral view, pygofer very short, more than twice as wide as long; anal segment without processes in ordinary sense, outer ventral corner more or less enlarged as an aedeagal guide; aedeagus with sides undulating, curved ventrally throughout; aedeagal brace not visible, styles widest just before apex, outer margins almost straight, inner sinuate, sharply narrowed on outer fifth; in caudal view, aedeagal brace not extended dorsally; styles widest at base, turned in on outer fourth.

#### EXPLANATION OF PLATE IX

41. Lateral view of genital capsule of male of *Delphacodes dentipennis* Beamer.
- 41a. Caudal view of styles and aedeagal brace of *Delphacodes dentipennis* Beamer.
- 41b. Lateral view of aedeagus enlarged of *Delphacodes dentipennis* Beamer.
42. Lateral view of genital capsule of male of *Delphacodes atralabis* Beamer.
- 42a. Caudal view of styles and aedeagal brace of *Delphacodes atralabis* Beamer.
43. Lateral view of genital capsule of male of *Delphacodes arcuata* Beamer.
- 43a. Caudal view of styles and aedeagal brace of *Delphacodes arcuata* Beamer.
- 43b. Lateral view of aedeagus enlarged of *Delphacodes arcuata* Beamer.
44. Lateral view of genital capsule of male of *Delphacodes aculeata* Beamer.
- 44a. Caudal view of styles and aedeagal brace of *Delphacodes aculeata* Beamer.
- 44b. Lateral view of aedeagus enlarged of *Delphacodes aculeata* Beamer.
45. Lateral view of genital capsule of male of *Delphacodes truncata* Beamer.
- 45a. Caudal view of styles and aedeagal brace of *Delphacodes truncata* Beamer.
- 45b. Lateral view of aedeagus enlarged of *Delphacodes truncata* Beamer.



41 *D. dentipennis*



41a



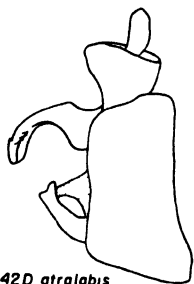
42a



41b



42b



42 *D. atralabis*



43b



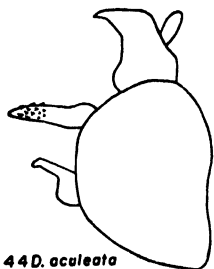
43 *D. arcuata*



43a



45a



44 *D. oculata*



44b



44a



45b



45 *D. truncata*

Holotype ♂, allotype ♀, 1♂ and 2♀ paratypes, Saucier, Miss., March 5, 1947, R. H. Beamer; other paratypes: 1♂, Ocean Springs, Miss., March 3, 1947, R. H. Beamer; 4♂♂ and 1♀, Ramsay, La., March 3, 1947, R. H. Beamer; 3♂♂ and 1♀, Sanford, Fla., March 11, 1947, R. H. Beamer; 3♀♀, same place and date, L. D. Beamer; 1♀, Otter Creek, Fla., March 3-9, 1947, R. H. Beamer; 2♂♂ and 1♀, Lamont, Fla., March 7, 1947, R. H. Beamer; 1♂, Mariana, Fla., March 7, 1947, R. H. Beamer; 1♀ and 1♂, Palatka, Fla., March 10, 1947, R. H. Beamer; 1♂, Mims, Fla., March 18, 1947, R. H. Beamer; 1♀, La Belle, Fla., March 13, 1947, R. H. Beamer; 8♂♂ and 2♀♀, Waycross, Ga., March 18, 1947, R. H. Beamer; 4♂♂, Cape Henry, Va., July 3, 1938, P. W. Oman; 1♀ Waycross, Ga., Oct. 5, 1938, P. W. Oman; 1♂, Eridu, Fla., July 11, 1939, P. W. Oman; 2♂♂, New Port Fitchey, Fla., Oct. 7, 1938, P. W. Oman; 1♂, Sanford, Fla., March 20, 1926, E. D. Ball.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

#### Correction

On page 68 of the April issue of the *Journal* the figures for *M. bivittatus* and *M. mexicanus* under Gamma Benzene Hexachloride should be exchanged.

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# *Journal of the Kansas Entomological Society*

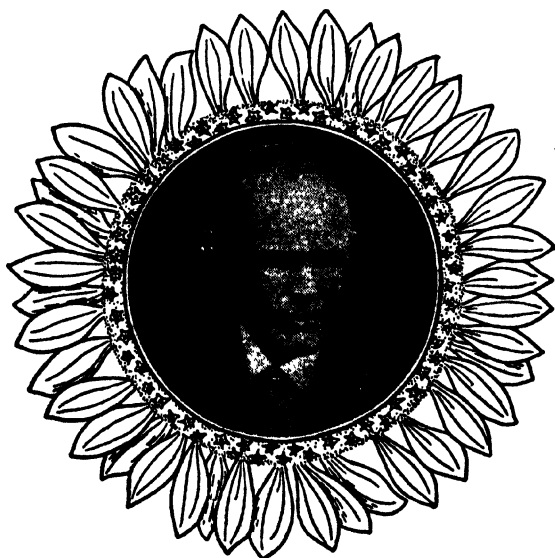
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**Vol. 21, No. 4, October, 1948**

*This issue mailed Dec. 30, 1948*

## SOME NEW SPECIES OF DELPHACODES (Homoptera, Fulgoroidea, Delphacinae)

R. H. BEAMER\*  
Lawrence, Kansas

### Part V

#### 46. *Delphacodes sucinea* n. sp.

##### Brachypterous form:

Resembling a *Pissonotus* in general appearance and obviously closely related to *Delphacodes truncata* Beamer, according to genital structure. Can be separated from this species by being generally honey colored, by the narrow white stripe on apices of most elytra, by the sharp tooth on ventro-caudal margin of pygofer and by a pair of large, sharp processes on ventral margin of aedeagus near base. Length ♂ 2mm; ♀ 2.2 mm.

**Structure:** First antennal segment slightly more than twice as long as wide; front scarcely one half longer than wide, widest at apical third, narrowed to each end, more so toward base, definitely tricarinate; crown almost twice as long as basal width, apex rounded, carinae distinct at base, almost absent at apex; elytra about as wide as long, veins indistinct, apices truncate, mesal margins extending farthest caudad; genital capsule narrowed, almost withdrawn into abdomen.

**Color:** General color honey brown surface shiny; elytra usually with a white dash on apical margins; genital parts visible externally, almost black.

**Genitalia.** In lateral view, pygofer more than twice as wide as long with a prominent tooth at middle of caudo-ventral margin; anal segment more or less rectangular with outer caudal corners rather projecting, not considered processes; aedeagus curved ventrad at base, narrowed near outer third, apex rounded, a pair of large, sharp processes near basal third on ventral margin, aedeagal brace not visible; styles almost straight with sides nearly parallel, tapered on outer third to quite sharp apices; in caudal view aedeagal brace not extended dorsad; styles with sides almost parallel, extended out on basal half, then curving in to angularly narrowed apices.

Holotype ♂, allotype ♀, 52 ♂ and 15 ♀ paratypes Saucier, Miss., March 5, 1947, R. H. Beamer; Other paratypes: 4 ♂ and 1 ♀, Ocean Springs, Miss., March 3, 1947, R. H. Beamer; 1 ♀ Live Oak, Fla., Jan 1, 1931, P. W. Oman; 1 ♂ Hilliard, Fla., Oct. 5, 1938, P. W. Oman; 1 ♂ Zolfo Springs, Fla., July 15, 1939, P. W. Oman; 1 ♀ North of Picnic, Fla., Sept. 8, 1938, P. W. Oman.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

\*Contribution from the Department of Entomology, University of Kansas



47. *Delphacodes penelutea* n. sp.**Brachypterous form:**

Resembling *Delphacodes lutea* Beamer but elytra truncate at apices and extending only to about middle of abdomen, while in *lutea* the apices of elytra are rounded and extend almost to genital capsule. Length, ♂ 2.2 mm.; ♀ 2.3 mm.

**Structure:** First segment of antennae about as long as wide; front not quite twice as long as wide, widest near apical third, narrowed toward each end, more so toward base, distinctly tricarinate; crown about one-third longer than wide, apex rounded, carinae fairly distinct; elytra about as wide as long, semihyaline, veins thickened, apices truncate, extending about to middle of abdomen.

**Color:** General color stramineous, abdomen of male usually mostly quite dark brown.

**Genitalia:** In lateral view: pygofer more or less trapezoidal, dorsal margin definitely narrower than ventral; anal segment without processes; aedeagus about four times as wide at base as at ventral bend near apex, two teeth ventrally on each side near middle, 3-4 teeth on dorsal margin at bend, apex sharp; aedeagal brace triangular widest at base; styles almost straight, enlarged at apex; in caudal view: aedeagal brace not extended dorsad; styles widest at base, sinuate on outer margin, more or less bifid at apices.

Holotype ♂, allotype ♀, 40 ♂ and 22 ♀ paratypes, Saucier, Miss., March 5, 1947, R. H. Beamer; other paratypes: 1 ♂ and 3 ♀ ♀, Woodville, Fla., March 7, 1947, R. H. Beamer; 4 ♂ ♂ and 2 ♀ ♀, Naples, Fla., March 16, 1947; R. H. Beamer; 12 ♂ ♂ and 1 ♀, Homestead, Fla., March 14, 1947, R. H. Beamer; 2 ♂ ♂ same place and date, L. D. Beamer; 1 ♂ Wakulla, Fla., July 11, 1939, P. W. Oman; 1 ♂ Sanford, Fla., Jan. 15, 1926, E. D. Ball.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

48. *Delphacodes paraparvula* n. sp.**Brachypterous form:**

Resembles *Delphacodes parvula* Ball, but anal segment of male with two pairs of processes instead of none. Length ♂ 1.5 mm.; ♀ 2.8 mm.

**Structure:** First segment of antennae twice as long as wide; front not quite twice as long as wide, widest near apical third, narrowed toward each end, distinctly tricarinate; crown about one-third longer than wide, apex rounded, carinae definite at base more or less obscure on apex; elytra semihyaline, about twice as long as wide, ending just before genital capsule, apices rounded, veins raised.

**Color:** General color stramineous, occasionally more or less indications of darker longitudinal rows of spots on abdomen, styles and processes of anal segment dark brown.

**Genitalia:** In lateral view; pygofer more or less rectangular, posterior ventral corner greatly extended; anal segment with two pairs of sharp processes, the first many times longer than second; aedeagus widest at base,

gently narrowing, curving ventrad from near middle to apex, with a pair of truncate teeth on right side near outer third and a pair of sharp teeth on left side in same position; aedeagal brace visible, oval in shape, notched on dorsal margin; styles with very large heels narrowed to more or less avicephaliform apices; in caudal view: aedeagal brace broad, extended dorsad about half its width; styles almost straight with avicephaliform apices, beaks on inner margin long and almost parallel sided.

**Holotype** ♂, **allotype** ♀, 7 ♂ and 2 ♀ paratypes. Pearlinton, Miss., March 3, 1947, R. H. Beamer.

Types and paratypes in Snow Entomological Collections.

#### 49. *Delphacodes concava* n. sp.

##### **Brachypterous form:**

Resembling *Delphacodes paraparvula* Beamer but elytra longer, usually reaching genital capsule, anal segment of male with one pair of processes, and aedeagal brace in caudal view undercut at each side. Length, ♂ 2.4 mm.; ♀ 2.7 mm.

**Structure:** First segment of antennae slightly more than twice as long as wide; front very slightly more than twice as long as wide, widest near apical third, slightly narrowed toward each end, definitely tricarinate; crown about one-third longer than basal width, apex rounded, carinae distinct; elytra semihyaline, about twice as long as wide, reaching or almost reaching genital capsule, apices rounded, veins thickened.

**Color:** General color stramineous, darker spot above middle and hind coxae and surrounding ocelli, abdomen generally dark brown with first segment golden yellow or dorsum.

**Genitalia:** In lateral view; pygofer about one-third wider than long, widest at base; anal segment with a pair of processes near middle; aedeagus widest at base, gradually narrowed and curved ventrad to tip, with four teeth on dorsal margin; aedeagal brace not visible; styles more or less pediform, narrowed on outer half; in caudal view: aedeagal brace extended dorsad about basal width, each margin under cut; styles narrowed in middle, apices avicephaliform, beak on inner margin, very broad.

**Holotype** ♂, **allotype** ♀, 24 ♂ and 7 ♀ paratypes, Woodville, Fla., March 7, 1947, R. H. Beamer; other paratypes 4 ♂ and 4 ♀, Tallahassee, Fla., March 7, 1947, R. H. Beamer; 1 ♂ same place and date, L. D. Beamer; 1 ♂, Sanford, Fla., Jan. 7, 1925, E. D. Ball; 1 ♀ Sanford, Fla., Feb. 16, 1926, E. D. Ball; 3 ♀ ♀ Sanford, Fla., Aug. 9, 1926, E. D. Ball; 2 ♂ ♂, Sanford, Fla., July 22, 1926, E. D. Ball; 1 ♂ Way Cross, Ga., March 18, 1947, R. H. Beamer.

Types and paratypes in Snow Entomological Collections; paratypes in United States National Museum.

#### 50. *Delphacodes ardentis* n. sp.

##### **Macropterous form:**

Resembling *Delphacodes bocana* Beamer but dorsum darker, with a median longitudinal light stripe, aedeagal brace visible in lateral view and greatly extended dorsad in caudal view. Length, ♂ 3 mm.; ♀ 3.5 mm.

**Structure:** First segment of antennae about twice as long as wide; front slightly more than twice as long as wide, widest near apical third, narrowed toward each end, slightly more so toward base, distinctly tricarinate; crown a little longer than basal width, carinae distinct; elytra about one-third longer than abdomen, widest near apex.

**Color:** General color stramineous; spot on hind coxae darker; area between carinae of front dark brown to black; dorsum with median longitudinal, narrow white line; elytra semihyaline with veins much darker, especially on outer half.

**Genitalia:** In lateral view; pygofer more or less rectangular, ventral margin about twice as long as dorsal, with small tooth at posterior corner; anal segment with pair of straight, sharp-pointed processes; aedeagus almost straight, about three times as wide at base as on outer third, three or four teeth on dorsal margin of outer third, two larger ones on right side near middle; aedeagal brace visible, triangular in shape, narrowed at base; styles widest near apices, more or less pediform; in caudal view: aedeagal brace greatly extended dorsad, widest at base; styles more or less avicephaliform at apices with beak on inner margin.

Holotype ♂, allotype ♀, Palatka, Fla., March 10, 1947, R. H. Beamer; 2 ♂ paratypes, Royal Palm Park, Fla., March 16, 1947, R. H. Beamer.

**Brachypterous form:**

Like the macropterous form except hind wings wanting and front wings reaching about to tip of abdomen.

Holomorphotype ♂ and 1 ♀ paramorphotype, Palatka, Fla., March 10, 1947, R. H. Beamer.

All types in the Snow Entomological Collections.

**51. *Delphacodes plenatra* n. sp**

**Brachypterous form:**

Resembling *Delphacodes opaca* Beamer but smaller, aedeagus curved ventrad and genital capsule not flaring in caudal view. Length, ♂ 1.2 mm; ♀ 1.6 mm.

**Structure:** First segment of antennae about as wide as long; front about one-third longer than wide, widest near outer third, narrowed toward each end, more so toward base, distinctly tricarinate, median carina enlarged; crown slightly longer than wide, carinae distinct; elytra about as wide as long, reaching to about second segment of abdomen, veins raised, apices rounded; genital capsule not flaring in caudal view.

**Color:** Male usually dark brown or black, female varying from stramineous to dark brown or black. Basal half of crown often much lighter.

**Genitalia:** In lateral view: pygofer about one-third longer on ventral than on dorsal margin; anal segment with one pair of more or less avicephaliform processes; aedeagus widest near middle, furcate on outer half, generally curved ventrad; aedeagal brace not visible; styles barely visible, apices narrowed; in caudal view: aedeagal brace not extended dorsad, slightly V-shaped; styles very large on basal half, narrowed to fourth basal width on outer half.

Holotype ♂, allotype ♀, 88 ♂ and 127 ♀ paratypes, Chino Valley, Ariz., July 12, 1947, R. H. Beamer; other paratypes: 18 ♂ and 8 ♀ ♀, Mescalera, N.M., June 27, 1947, R. H. Beamer; 16 ♂ ♂ and 10 ♀ ♀, Belen, N. M., July 1, 1947, R. H. Beamer; 51 ♂ ♂ and 21 ♀ ♀, Chiricahua Mts., Ariz., July 5, 1947, R. H. Beamer; 27 ♂ ♂ and 15 ♀ ♀, Vernal, Utah, Aug. 2, 1947, R. H. Beamer.

**Macropterous form:**

Like the brachypterous form except with flight wings which extend about one-third their length beyond the abdomen.

Holomorphotype ♀ and 8 ♀ paramorphotypes, Chino Valley, Ariz., Aug. 12, 1947, R. H. Beamer.

Types and paratypes in the Snow Entomological Collections.

**52. *Delphacodes venusta* n. sp.**

**Macropterous form:**

Resembling *Delphacodes gillettei* (Van D.) but much lighter in color, aedeagal brace of male extended dorsad in caudal view with undercut sides. Length to tip of wings, ♂ 5 mm.

**Structure:** First antennal segment about as long as wide; front twice as long as wide, widest near middle, narrowed toward each end, slightly more so toward base; crown distinctly longer than wide, carinae distinct; elytra extend about one-third their length beyond abdomen, widest beyond cross veins, veins raised.

**Color:** General color stramineous, an occasional specimen with usual darker regions, the average specimen with only a darker spot above hind coxae.

**Genitalia:** In lateral view: pygofer more or less rectangular; anal segment with one pair of heavy, sharp processes; aedeagus long, sinuate, enlarged on outer third with about three rows of short teeth; aedeagal brace narrow, sides parallel; styles pediform, apices narrowed; in caudal view: aedeagal brace extended dorsad, deeply undercut on either side, apex rounded; styles widest at base, narrowed to rather sharp apices.

Holotype ♂ and 17 ♂ paratypes, Ft. Davis, Tex., June 22, 1947, R. H. Beamer.

Types in the Snow Entomological Collections.

**53. *Delphacodes compta* n. sp.**

**Brachypterous form:**

Resembling *Delphacodes lineatipes* (Van D.) but with cross bands of white. Length, ♂ 1.7 mm.; ♀ 2 mm.

**Structure:** First segment of antennae slightly longer than wide; front one-third longer than wide, widest near apical third, narrowed to each end, more so toward base, strongly tricarinate; crown slightly longer than wide, widest at apex, carinae distinct; elytra as wide as long, apices truncate, venation not distinct.

**Color:** General color dark brown to black; carinae of front and crown stramineous, this light portion ending near middle of crown; posterior half of pronotum and apical third of elytra almost white; semblance of broad,

median, dorsal stripe on apical half of abdomen lighter, usually last three abdominal segments with a light spot on lateral margin; legs fulvous.

**Genitalia:** In lateral view: pygofer narrowed on dorsal margin, with definite tooth on caudo-ventral corner; anal segment without teeth in usual sense but with a short, sharp flange on caudo-dorsal corner; aedeagus widest at base, slightly narrowing and curving ventrad to tip with about four retrorse teeth on dorsal margin of outer half; aedeagal brace not visible; styles widest at base, tapering to apices; in caudal view; aedeagal brace not extended dorsad; styles widest at base, narrowing to more or less avicephali-form apices with beak on inner margin.

Holotype ♂, allotype ♀, 33 ♂ and 28 ♀ paratypes, Del Mar, Calif., July 22, 1947, R. H. Beamer.

Types in Snow Entomological Collections.

#### 54. *Delphacodes munda* n. sp.

##### **Brachypterous form:**

Resembling *Delphacodes campestris* (Van D.) but male with black spot on pronotum back of each eye and both sexes with region between frontal carinae brown to black. Length, ♂ 1.9 mm.; ♀ 2.3 mm.

**Structure:** First segment of antennae twice as long as wide; front slightly more than twice as long as wide, widest near middle, very slightly narrowed at apex, more so toward base, definitely tricarinate; crown as long as wide, carinae definite; elytra reaching genital capsule, apices rounded.

**Color:** General color stramineous; parts of coxae, spots above them, most of genae, area between frontal carinae, spot on pronotum back of each eye, sides of scutellum and more or less dorsum of abdomen brown or black.

**Genitalia:** In lateral view: pygofer about as long as wide; anal segment with a pair of curved, sharp-pointed processes, about as long as basal width; aedeagus widest at base, narrowed to apex, curving ventrad on outer third, four teeth on dorsal margin near base and about six teeth along ventral margin near middle; aedeagal brace not visible; styles widest at base, narrowed on outer third; in caudal view: aedeagal brace extended dorsad about its basal width; styles widest at base, almost parallel-sided on

#### PLATE VII

- 46. Lateral view of genital capsule of male of *Delphacodes sucinea* Beamer.
- 46a. Caudal view of styles and aedeagal brace of *Delphacodes sucinea* Beamer.
- 46b. Lateral view of aedeagus enlarged of *Delphacodes sucinea* Beamer.
- 47. Lateral view of genital capsule of male of *Delphacodes penelutea* Beamer.
- 47a. Caudal view of styles and aedeagal brace of *Delphacodes penelutea* Beamer.
- 47b. Lateral view of aedeagus enlarged of *Delphacodes penelutea* Beamer.
- 48. Lateral view of genital capsule of male of *Delphacodes paraparvula* Beamer.
- 48a. Caudal view of styles and aedeagal brace of *Delphacodes paraparvula* Beamer.
- 48b. Lateral view of aedeagus enlarged of *Delphacodes paraparvula* Beamer.
- 49. Lateral view of genital capsule of male of *Delphacodes concava* Beamer.
- 49a. Caudal view of styles and aedeagal brace of *Delphacodes concava* Beamer.
- 49b. Lateral view of aedeagus enlarged of *Delphacodes concava* Beamer.
- 50. Lateral view of genital capsule of male of *Delphacodes argentis* Beamer.
- 50a. Caudal view of styles and aedeagal brace of *Delphacodes argentis* Beamer.
- 50b. Lateral view of aedeagus enlarged of *Delphacodes argentis* Beamer.



46 *D. succinea*



46a



46b



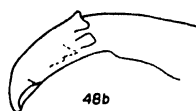
47b



47a



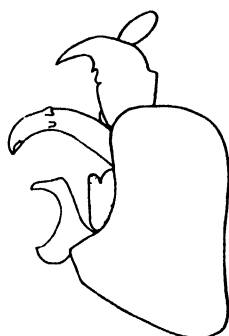
47 *D. penelutea*



48b



48a



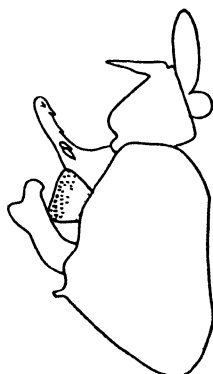
48 *D. paraparvula*



49b



49a



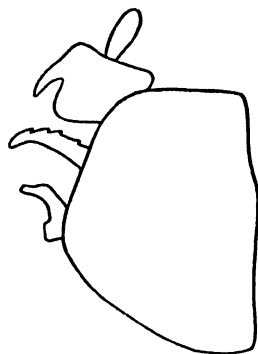
50 *D. ardentis*



50a



50b



49 *D. concava*

basal two-thirds, avicephaliform at apices, long, slender beak on inner margin.

Holotype ♂, allotype ♀, 1 ♂ and 1 ♀ paratype, Craig, Colo., August 3, 1947, R. H. Beamer.

Types in Snow Entomological Collections.

#### 55. *Delphacodes alata* n. sp.

##### Brachypterous form:

Resembling *Delphacodes paraparvula* Beamer but aedeagus of male straight instead of curved ventrad. Length, ♂ 2 mm.; ♀ 2.5 mm.

**Structure:** First segment of antennae twice as long as wide; front about twice as long as wide, widest on apical third, narrowed toward each end, much more so toward base; crown one-third longer than wide, rounded at apex, carinae indistinct on anterior half; elytra about one-third longer than wide, apices narrowed and rounded, veins raised.

**Color:** General color stramineous; spot above hind coxae darker; only indications of other usual darker areas.

**Genitalia:** In lateral view: pygofer more or less rectangular, narrowed posteriorly; anal segment with two pairs of processes, the second very short; aedeagus long and straight, slightly tapered from base, a large, broad, flat process on left side of shaft near apex, another smaller serrated process on right side at tip; aedeagal brace small, more or less rectangular; styles pediform, heels large, tips bifid; in caudal view: aedeagal brace broad, slightly extended dorsad; styles enlarged at apices more or less avicephaliform.

Holotype ♂, allotype ♀, Big Pine Key, Fla., March 15, 1947, R. H. Beamer; paratypes: 2 ♂ and 1 ♀, Naples, Fla., March 16, 1947, R. H. Beamer; 1 ♂, Homestead, Fla., March 14, 1947, R. H. Beamer.

Types and paratypes in Snow Entomological Collections.

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#### PLATE VIII

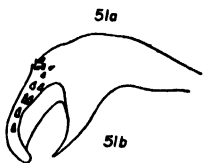
- 51. Lateral view of genital capsule of male of *Delphacodes plenatra* Beamer.
- 51a. Caudal view of styles and aedeagal brace of *Delphacodes plenatra* Beamer.
- 51b. Lateral view of aedeagus enlarged of *Delphacodes plenatra* Beamer.
- 52. Lateral view of genital capsule of male of *Delphacodes venusta* Beamer.
- 52a. Caudal view of styles and aedeagal brace of *Delphacodes venusta* Beamer.
- 52b. Lateral view of aedeagus enlarged of *Delphacodes venusta* Beamer.
- 52c. Ventral view of aedeagus enlarged of *Delphacodes venusta* Beamer.
- 53. Lateral view of genital capsule of male of *Delphacodes compta* Beamer.
- 53a. Caudal view of styles and aedeagal brace of *Delphacodes compta* Beamer.
- 53b. Lateral view of aedeagus enlarged of *Delphacodes compta* Beamer.
- 54. Lateral view of genital capsule of male of *Delphacodes munda* Beamer.
- 54a. Caudal view of styles and aedeagal brace of *Delphacodes munda* Beamer.
- 54b. Lateral view of aedeagus enlarged of *Delphacodes munda* Beamer.
- 55. Lateral view of genital capsule of male of *Delphacodes alata* Beamer.
- 55a. Caudal view of styles and aedeagal brace of *Delphacodes alata* Beamer.
- 55b. Lateral view of aedeagus enlarged of *Delphacodes alata* Beamer.



51 *D. plenatra*



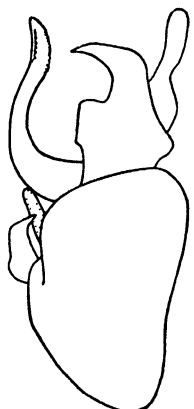
51a



51b



52c



52 *D. venusta*



53b



53a



53 *D. compta*



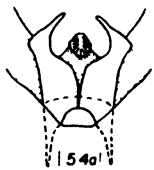
52a



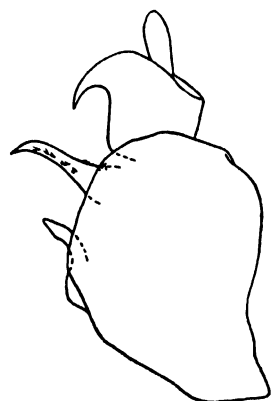
52b



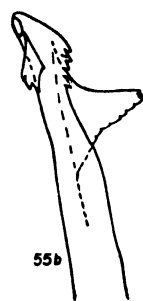
54b



54a



54 *D. munda*



55b



55 *D. alata*



55a



## SOME BICOLORED MOSQUITO LARVAE

OSMOND P. BRELAND

Austin, Texas.

The larvae of mosquitoes in the United States usually do not exhibit two contrasting colors; in fact, the phenomenon is so rare as to cause comment when such larvae are discovered. The writer has noted but two species of mosquitoes in the United States that have been reported as having bicolored larvae. These are *Aedes bimaculatus* (Coquillett) (Ross 1943), and *Aedes tormentor* Dyar and Knab (King, Bradley and McNeel 1944). This condition is apparently not invariable for these species. Ross considers that this coloring is "remarkable" for *A. bimaculatus*, while King, Bradley and McNeel state that only an occasional specimen of *A. tormentor* is so colored.

On July 2, 1948, the writer and his associates collected a large number of mosquito larvae from temporary pools in Palmetto State Park, some 7 miles south of Luling, Texas. In one of the collecting jars there appeared a single bicolored larva which was conspicuous even to the unaided eye. Four collectors then returned to the pool from which the specimen was obtained and spent approximately an hour searching for additional specimens. The water was literally teeming with larvae of several species including *Psorophora howardii* Coquillett, *P. cyanescens* (Coq.), *P. longipalpus* Roth and *Aedes vexans* (Meigen). Only about twenty larvae of this type were collected, most of them being second and third instars.

Under the dissecting microscope it was noted that the thorax and the seventh and eighth abdominal segments were white, while the remainder of the body was very dark. The color was uniform for all specimens and all instars examined. Previously reported similar larvae differ somewhat from those collected by the writer. Larvae of *A. bimaculatus* were semi-transparent except for the head, the sixth and seventh abdominal segments (Ross 1943). Larvae of *A. tormentor* have been reported as being white on the thorax and the eighth abdominal segment only, while the remainder of the body was black (King, Bradley and McNeel, 1944).

Most of the larvae became fourth instars, but none pupated. Several permanent mounts of the fourth instars were made, and these retained their conspicuous color for several days, but gradually became more uniform as the mounting medium hardened. These larvae fit the description of the larva of *A. tormentor* as originally described by Dyar and Knab (1906), as well as subsequent more detailed descriptions, and it is believed that the larvae were indeed those of this species. However, since adults were not available for study, and in view of the limited knowledge concerning *A. tormentor*, this cannot be stated with certainty. At the present time *A. tormentor* can be distinguished from *A. atlanticus* Dyar and Knab only on the bases of larvae and male terminalia.

Larvae of *A. tormentor* are usually considered to be rare (Carpenter, Middlekauf and Chamberlain 1946). The species has been reported from the southeastern part of Texas (McGregor and Eads 1943), although collections indicate that the species is not common in this area. The writer has been

collecting mosquitoes in Texas for several years, and has collected several times from the same pool from which these bicolored larvae were obtained. Never before have larvae of this type been found. The present collections were made a few days after a heavy rain, and it seems probable that larvae of this species could be found only for a few days after temporary pools had been formed.

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## A NEW CAPITOPHORUS APHID

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The following report includes the description of an apparently undescribed aphid of the genus *Capitophorus* from New Mexico, with notes on additional species.

### *Capitophorus stroudi* n. sp.

A series of pale colored aphids, collected by Mr. Clyde F. Stroud at White Sands National Monument, New Mexico, were received for identification. The *Capitophorus* material proved of particular interest as it resembled several species of this aphid genus occurring on rabbitbrush, *Chrysothamnus*, with which the writer is acquainted. Mr. Stroud reported the host as "brush," either *Chrysothamnus nauseosus* var. *latisquameus* (A. Gray) or *Poliomintha incana* (Torr.) A. Gray, and I strongly suspect the former. The aphids were collected by sweepings.

**Apterous vivipara:** Body 2.35 to 2.45 mm. long, color evidently not dark; hairs on vertex flattened, approximately .033 to .041 mm. long; ocular tubercles poorly developed or absent; antennal tubercles moderately well developed, exceeding ends of hairs on vertex; antennae 3.11 to 3.2 mm. long, dusky to blackish beyond base of III; antennal III, .57 to .66 with 4 to 6 rounded sensoria on basal half; IV, .62 to .67 mm., longer than III; V, .54 to .57; VI, .11 to .12 plus .84 to .9 mm. long; rostral tip pointed but not needle-like; rostral IV+V, .015; cornicles almost cylindrical but with slight enlargement toward distal end before flange and dusky to blackish beyond basal paler area; cauda total length .3 to .36 mm. long, paler than cornicles, with 3 or 4 lateral hairs on each side; anal plate dusky and rounded to somewhat angular at apex.

**Alate vivipara:** Body 2.13 mm. long; hairs on vertex flattened, particularly toward tip; width through eyes .52 mm.; ocular tubercles present; antennal tubercles moderately developed; antennae (broken) blackish beyond base of III with (21 or more) sensoria in crowded single row on third segment; hairs on antennae short, blunt to spear shape at end; rostrum pointed, IV+V .106 mm. long; hairs on sides of prothorax broadly flattened to funnel shape; abdomen armed with short flat to fan-shaped hairs on sides and dorsum, with pointed hairs on ventral surface; cornicles dusky to blackish, .5 mm. long, generally cylindrical with slight enlargement on inner surface before distal flange; cauda dusky, .35 mm. long with 3 or 4 hairs on each side.

**Collections:** Doubtless from *Chrysothamnus nauseosus* var. *latisquameus* in net sweepings at White Sands National Monument, Otero County, New Mexico, on June 20, 1947 and August 4, 1947, by Clyde P. Stroud.

**Taxonomy:** *Capitophorus stroudi* n. sp. runs to the *Capitophorus gregarius*, *C. zerozoous* couplet in Knowlton and Smith's key (Canad. Ent., 68:107-108, 1936). From both these species it varies in lacking definite dorsal tubercles on the abdomen. It further differs from *C. gregarius* Knlt. in having paler body color, smaller body size, fewer and less conspicuous body hairs, and longer antennal III. In *C. stroudi*, antennal IV is longer than III, while the reverse is true in *C. gregarius* and *C. zerozoous* K.-S. *Capitophorus stroudi* keys to *Capitophorus wasatchii* Knlt. or *C. oestlundii* Knlt., from which species it differs in having fewer and less conspicuous body hairs; lacking the flattened hairs on dorsal surface of cauda possessed by *oestlundii*, and with less definitely cylindrical cornicles than *wasatchii*.

Additional *Capitophorus* records at hand include the following:

*Capitophorus brevinectarius* G.-P. on *Artemisia*, Elk Springs, Colorado, June 25, 1937 (G. F. Knowlton, Det. M. A. Palmer).

*C. brevipilosus* (Baerg) on *Fragaria*, Knoxville, Tenn., August 4, 1924, (S. Marcovitch).

*C. chlorophainus* K.-S. on *Chrysothamnus nauseosus* at Cache La Poudre Canyon, Colorado, August 23; at Gould, Colorado, August 22; and Estes Park, Colorado, August 1940 (Knowlton). *Macrosiphum escalantii* K. also was collected with this species on *Chryso. viscidiflorus* at Linland, Colorado, August 19, 1935 (Knowlton).

*C. decampus* K.-S. on *Artemisia tridentata* at Sisters, Oregon, August 24, 1944 (Knowlton) and on sagebrush, Emery, Utah, August 4, 1932 (Knowlton).

*C. elongatus* K. on *Chrysothamnus parryi*, Orangeville, Utah, 1945, and Circleville, Utah, September 16, 1935 (Knowlton); on *C. nauseosus* at Oak Creek Canyon, Utah, July 10, 1942 (Knowlton).

*C. glandulosus* (Kalt.) on *Artemisia frigida*, Beaver Mt., Utah, July 10, 1942 (Knowlton); on *A. vulgaris*, Avon, Paradise, and Blacksmith Fork Canyon, Utah, August 5, 1937 (Knowlton); abundant on *A. frigida*, Teton Pass, Wyoming, July 20, 1946 (Knowlton); on *A. tridentata* at Flagstaff, Arizona, September 1944 (Knowlton); on *A. frigida* at Cameron Pass, Colorado, August 20, 1940 (Knowlton); at Pingree Park, Colorado, August 24, 1935 (Knowlton-A. C. Maxson); at Glendale, Utah, July 4, 1946 (Knowlton).

*C. gregarius* (K.) on *Chrysothamnus nauseosus nauseosus*, north of Rock

Candy Mountain, Sevier County, Utah, June 25, 1947 (Knowlton).

*C. magnautensis* K.-S. on *Chrysothamnus viscidiflorus* sub sp. *linifolius* at Duchesne, Utah, July 14, 1927 (Knowlton). Specimens collected on this host at Randlett, Utah, July 14, 1927 (Knowlton) were part of the paratype series studied. This locality record was omitted by error from the localities with the original description.

*C. minor* (Forbes) on strawberry at: Waldo, Florida, February 26, 1932 (A. N. Tissot); Pemberton, New Jersey, May 19, 1915 (N. B. Seamonell); Plant City, Florida, April 18, 1930 (C. F. Stahl); New York, June 6, 1914 (C. E. Olsen); Knoxville, Tennessee, May 2, 1916 (G. M. Bentley); Chadbourn, North Carolina, December 2, 1931 (L. B. Reed).

*C. oestlundii* Knt. on *Chrysothamnus nauseosus* *nauseosus*, north of Rock Candy Mountain, Utah, June 25, 1947 (Knowlton); *C. nauseosus*, Du Bois, Idaho, July 19, 1946 (Knowlton); *Chrysothamnus*, Moses Lake, Washington, April 17, 1947; Winemucca, Nevada, July 24, 1944 (Knowlton); *C. nauseosus* at Elmo and south end of Flathead Lake, Montana, July 28, 1946 (Knowlton); Overton, Nevada, April 26, 1936 (Knowlton); Cache La Poudre Canyon, Colorado, August 23, 1940 (Knowlton); Elk Springs, Colorado, August 18, 1935 (Knowlton), Kanab, Utah, on *C. greeni*, August 10, 1936 (Knowlton-C. F. Smith); Wells and Snowwater Lake, Nevada, August 20, 1943 (Knowlton); Elco and Verdi, Nevada, July 23, 1944 (Knowlton).

*C. potentillae* (Walker) on wild rose, Union Gap, Washington, April 7 and 16, 1947; on *Potentillae* in greenhouse, Corvallis, Oregon (L. Weaver); on *Fragaria*, Sumas, Washington, August 25, 1947 (C. H. Johansen); Plant City, Florida, April 22, 1930 (C. F. Stahl); Walnut Creek, California, February 1, 1913 (W. M. D.); San Francisco, California (H. Morrison); Lacombe and Brookings, Oregon, November 15, 1933 (R. Dimick, Det. A. N. Tissot); Corvallis, Oregon, July 13, 1936 (L. Weaver); on rose at: Booneville Dam, Oregon, Logan, Weber Canyon, and Logan Canyon, Utah; Flagstaff, Arizona (Knowlton); and Shoshone Lake, Wyoming, September 11, 1941 (Knowlton-H. F. Thornley); Livingston, Montana, July 31, 1942 (Thornley).

*C. quadririchus* K.-S. on *Artemisia tridentata* at Butlerville, Utah, June 15, 1937 (Knowlton); Logan Dry Canyon, Utah, June 18, 1944 (S. L. Wood).

*C. ribis* (L.) damaging red currant foliage at Lakepoint, Hyrum, and Farmington, Utah, 1947; *Ribis vulgaris*, Boston, Mass., July 8, 1921 (H. Morrison); Warrenton, Virginia, June 11, 1925 (Nelson Fell); Churchtown, Pa., June 11, 1901; Grand Rapids, Michigan, June 15, 1916; Essen, Prussia, Germany, July 8, 1898; Brussels, Belgium (S. H. Schouteden); District of Columbia, April 23, 1897; Providence, R. I., July 20, 1917 (G. M. Emerson); St. Paul, Minn. (A. C. Baker); Wooster, Ohio, July 16, 1920 (P. R. Lowry).

*C. wasatchii* Knt. on *Chrysothamnus*, Moses Lake, Washington, April 17, 1947.

*C. xanthii* (Oest.) on cocklebur, Vineyard, Utah, July 31, 1937 (Knowlton-L. L. Hansen); Logandale, Nevada, May 1947 (Knowlton).

*C. xerozoous* K.-S. on *Chrysothamnus greeni*, Fillmore, Utah, July 9, 1942 (Knowlton).

## NEW AND LITTLE KNOWN NEOTROPICAL DORILAIIDAE (Pipunculidae—Diptera)

D. ELMO HARDY

Ames, Iowa.

The material discussed in this paper has been received for study from The American Museum, the U. S. National Museum, the Museum of Comparative Zoology, and Ohio State University. The writer is indebted to these institutions for having had the privilege of studying their Neotropical Dorilaidae.

### **Dorilas (Eudorylas) buscki (Malloch)** (Figs. 1a-c)

*Pipunculus buscki* Malloch, 1912, Smith, Misc. Coll., 60:3-4.

This species is characterized by its dark fumose wings, small third antennal segment, absence of abdominal fasciae and very long appendix of the cubital cell.

**Male. Head:** Eyes joined on the front for a distance slightly greater than the length of the frontal triangle. Front and face grayish brown. Occiput gray on sides and below, brownish on the upper portion. Labellum yellowish, palpi and antennae brown to blackish. Third antennal segment small and obtuse at the apex (fig. 1a). **Thorax:** Brown on the dorsum, gray on the sides. Propleura bare, dorsocentral hairs very minute; marginal scutellar hairs present but microscopic and inconspicuous. Humeri, tegulae and halteres brownish to black. **Legs:** Chiefly brown to black, bases of tibiae yellow. Femora moderately swollen, flexor spines present, although rather weak, on the first two pairs; hind femora with several pairs of flexor bristles near apices below. Middle femora each with a row of fine pale hairs on the outside near upper portion. Middle coxae each with a row of strong black bristles at apices above. Hind tibiae without strong erect bristles on the outside. Pulvilli and tarsal claws about equal in length to the last subsegment of the tarsus. **Wings:** Rather dark brownish fumose, slightly lighter at the base and along hind margin. Stigma dark brown and filling all of the third costal section. Third section about one and one-half times longer than the fourth. The two sections combined are slightly longer than the fifth. Crossvein r-m located beyond the end of the subcostal vein and at the middle of the discal cell. Last section of the fourth vein gently curved. Last section of the fifth vein equal in length to the m crossvein. Petiole of cubital cell about three times longer than the r-m crossvein and nearly equal to the length of the last section of the fifth vein. **Abdomen:** Opaque brown to blackish, very faintly grayed on the sides and posterior angles of the segments. Sides slightly rounding, widest at about segment three. First tergum with a row of five to six strong black bristles on each side, abdomen otherwise clothed very sparsely with fine short hairs. Very small portions of the sixth and seventh terga are visible from a dorsal view. **Hypopygium:** About equal in length to the fifth abdominal segment, with a large apical membranous area on the right side and a small keel-like appendage in the middle

of the depressed area (fig. 1b). The coxopodite is brownish red in color and the harpagones are yellow brown. The latter appear, in the undissected specimen, to be broad, rather short and blunt at apices.

**Length:** body, 2.25-3.3 mm.; wings, 4.0-4.7 mm.

Malloch gave the length as  $1\frac{1}{2}$  mm. Mr. Green has checked the type and reported that this measurement was incorrect, the type is 2.25 mm.

**Female.** This is the first description of this sex. The front is much broader than the face, nearly two times wider at its greatest width. The front is opaque brownish except just above the antennae where it is grayish. The face is gray pubescent, brown in color. The third section of the costa about equal in length to the fourth. **Ovipositor:** base shining black, subelongate, with a strong tubercle below. Piercer long and slender, two times longer than the base (fig. 1c), and extending up between the legs to the front coxae.

**Length:** body, 3.2 mm.; wings, 4.5 mm.

Type locality: Taboga Island, Panama.

Specimens have been studied from Barro, Colorado, Canal Zone. July 13, 1924 (N. Banks) and Ft. Sherman, Panama. July 3, 24 (N. Banks).

#### ***Dorilas (Eudorylas) interruptus* (Malloch)**

(Figs. 2a-b).

*Pipunculus interruptus* Malloch, 1912, Smith Misc Coll., 60.1-2.

This species is apparently related to *D. scotinus* (Collin) but the third antennal segment is more acute, the abdominal fasciae much narrower and the middle femora with a row of long conspicuous hairs along outer side.

**Male. Head:** Eyes joined for a distance slightly greater than the length of the frontal triangle. Front and face dull gray pubescent. Antennae dark brown to blackish, bristles of the under side of the second segment as long as the third segment. Third segment short acute to obtuse at apex, in the specimen at hand it is rounded below (fig. 2b), in the type it is very slightly pointed. **Thorax:** Chiefly brownish gray pollinose on the dorsum, gray on the sides. Propleura bare, marginal scutellar hairs weak. Humeri, tegulae and halteres dark brown to black. Metanotum with a transverse depressed area near the upper margin. **Legs:** Chiefly black, apices of femora and bases of tibiae yellow, tarsal subsegments brownish. Femora moderately stout, flexor spines present on all legs. Middle coxae each with a row of black bristles at apices above, middle femora each with a row of long black hairs posteriorly. Hind tibiae with two strong black bristles on the outside of the swollen portion. Tarsal claws and pulvilli are about equal in length to the last subsegment of the tarsus. **Wings:** Lightly fumose, stigma pale brown and filling all of the third costal section. Third section one and one-half times longer than the fourth and about three-fourths as long as the fifth section. The r-m crossvein is located just beyond the basal third of the discal cell. The last section of the fourth vein is rather strongly curved. The petiole of the cubital cell is about one-half as long as the last section of the fifth vein. **Abdomen:** Velvety opaque black, with narrow grayish white fasciae along the posterior margin of each tergum; these fasciae are interrupted by the black in the middle of the segment (fig. 2a). Abdomen

sparsely covered with short fine hairs, longer hairs on the sides. The sixth and seventh terga are visible from a dorsal view. **Hypopygium:** About half to three-fourths as long as the fifth abdominal segment, rather symmetrical in shape but with a large apical membranous area on the right side (fig. 2a). The harpogones are short, broad and blunt.

**Length:** body, 4.0-4.3 mm.; wings, 5.3 mm.

Malloch gave the length of the type as 2½ mm.

**Female.** The writer has not seen this sex. Malloch states that the upper two-thirds of the front is opaque brown and the lower third silvery. The third antennal segment is slightly more rounded at apex than in the male. The piercer of the ovipositor is longer than its black globose base and extends to slightly beyond the apex of the third abdominal segment.

**Type locality:** Taboga Island, Panama.

Type in U. S. National Museum.

The writer has studied a homotype from the type locality.

***Dorilas (Eudorylas) longipilus* n. sp.**

(Figs. 3a-b)

This species is related to *D. peruensis* Hardy. It is distinguished by having the sides of abdominal segments two to four and all of the venter yellow; by the entirely yellow legs, humeri and halteres, the difference in the wing venation and the long hairs on the scutellum and abdomen.

**Male. Head:** Junction of the eyes equal in length to the frontal triangle. Front and face silvery pubescent, face broad, two times wider than the lower portion of the front. Occiput chiefly light gray pollinose. Mouthparts and third antennal segment bright yellow, first and second segments brown. Third antennal segment produced at apex into a very long bristle like projection, this is two and one-half times longer than the remainder of the segment and is equal to the arista (fig. 3a). Basal portion of aristae yellow, remainder black. **Thorax:** Chiefly black in ground color, brownish gray pollinose above, gray on the sides. Humeri, tegulae and halteres bright yellow. Propleura bare, dorsocentral hairs indistinct, marginal scutellar hairs very long and yellow, almost as long as the scutellum. Metascutellum not convex and with a transverse depression near the upper edge. **Legs:** Entirely yellow. Femora very slender, devoid of flexor spines except for a few small ones on the middle pair. All tibiae with rather strong apical spines below and with one or more strong, erect bristles on the outside of the swollen portion. Each tarsal subsegment rather strongly produced at apex above. Tarsal claws and pulvilli normal in size, scarcely longer than the last subsegment. **Wings:** Lightly fumose, stigma pale brown and filling all of the third costal section. Fourth costal section one and one half times longer than the third and almost equal in length to the fifth. Crossvein r-m situated at the basal one-fourth to one-fifth of the discal cell. Last section of the fourth vein very gently curved. **Abdomen:** Very slightly clavate from dorsal view, widest at segment five. Dorsum brown to black in ground color and brownish gray pollinose, terga two to four with a yellow spot on each side. Venter entirely yellow. First tergum with four or five very long,

yellow bristles on each side, these are longer than the first abdominal segment. Posterior portion of abdomen clothed with long yellow hairs, these are more abundant and longer on the sides. Seventh tergum scarcely visible from a dorsal view. **Hypopygium:** About three-fourths as long as the fifth abdominal segment, densely gray pubescent and yellow pilose and with a rather small apical membranous area (fig. 3b). The coxopodite and harpagones are bright yellow, the latter are broad and very short, in the undissected specimen, they appear to be as broad as long.

**Length:** body, 5.0 mm.; wings, 7-8 mm.

Female unknown.

Holotype male: Pichincha, Ecuador, Paramo of Cerro Paschoa 3300 m.. XI-12-1938 (F. Brown).

Type returned to the American Museum.

**Dorilas (Cephalosphaera) mocaensis n. sp.**

(Figs. 4a-b)

This species is most closely related to **D. (Cephalosphaera)**<sup>1</sup> **panamaensis** Hardy than to any other known neotropical species which have an appendiculate fourth vein in the wing. It is readily distinguished by the very long acuminate third antennal segment, the chiefly black femora, poorly developed pulvilli and tarsal claws and the dark brown to black, curved ovipositor. The front is also more broad and not narrowed above as in **panamaensis**.

**Female. Head:** Front, face and occiput silvery gray pubescent. Front as wide as the face and but very slightly narrowed above. Mouthparts and antennae bright yellow. The third antennal segment long acuminate below, the slender projected apex is three-fourths as long as the remainder of the third segment (fig. 4b). The basal portion of each arista is yellow. **Thorax:** Grayish brown on the dorsum, gray on the sides. Propleura each with a fan of long yellow hairs. Dorsocentral hairs distinct, although short. The scutellum has a row of rather strong bristles on its hind margin. The humeri and tegulae are yellow with a slight tinge of brown. The halteres are pale yellow. **Legs:** Coxae and femora chiefly dark brown to black, trochanters, tibiae and tarsi yellow. Extreme bases and apices of femora yellow, apical subsegments of tarsi brownish. Hind trochanters with numerous short yellow hairs below. Femora stout, flexor spines well developed. Tibiae without apical spurs or spines and with no large bristles on the outside of the swollen portion. Tarsal claws and pulvilli rather small, about equal in length to the last subsegment of tarsus. **Wings:** Hyaline, stigma light brown and filling all of the third costal section. Third section slightly longer than the fourth, the two combined are one and one-half longer than the fifth. Crossvein r-m located beyond the apex of the subcostal vein and at about the basal 3/7 of the discal cell. The ultimate section of the fourth vein ( $M_1$ ) is one and three-fourths longer than the penultimate section ( $M_{1,2}$  beyond m crossvein). The appendix on the fourth vein reaches about one-third the

<sup>1</sup>The status of **Cephalosphaera** is being discussed in the writer's report of the Dorilidae of the De Witte Expedition to the Belgian Congo.



distance to the wing margin. The last section of the fifth vein is longer than the m crossvein and the petiole of the cubital cell is slightly less than the length of the r-m crossvein. **Abdomen:** Sides straight or nearly so, very slightly widest at segments three to four. First tergum entirely gray, second tergum all gray except for narrow apical border of brown. Terga three and four brown, except for gray side spots. Fifth tergum chiefly gray, with narrow brown posterior and anterior margins and a median brown vitta. Sixth tergum gray, except for the brown anterior margin, the brown pollen extends into the gray for a short distance in the middle of the tergum. First tergum with a row of four to six short yellow bristles on each side, abdomen otherwise sparsely haired. Hind margin of sixth tergum not excised. **Ovipositor:** Base short, entirely black in color. Piercer thick and curved downward, dark reddish brown to blackish in color, slightly longer than its base and extending almost to the base of the second abdominal segment (fig 4a). A distinct suture is present just behind the vaginal orifice which separates the piercer from the base.

**Length:** body, 4.4 mm.; wings, 6.0 mm.

Male unknown.

Holotype female: Moca, Guatallon, 1,000 m. Mar.-Apr. 1931.

Type returned to the American Museum of Natural History.

**Dorilas (Eudorylas) rex (Curran)**  
(Figs. 5a-e)

**Pipunculus rex** Curran, 1934, Bull. Amer. Mus. N. H., 66 416.

This species belongs in the atlanticus group and appears most closely related to *D. aquavicus* Hardy. It is distinguished by the large apical membranous area of the male hypopygium; by the small third antennal segment; chiefly black femora and fumose wings

**Male. Head:** The eyes are not distinctly separated and the junction is equal to the length of the frontal triangle. Front and face silvery gray pubescent. Occiput dark gray on sides and below, brownish on upper portion. Labellum yellowish, palpi and antennae blackish brown. Third antennal segment not much larger than the second and rounded below (fig. 5a). The type, figured by Curran, has the third antennal segment more correct and is slightly smaller than that of the specimen at hand. **Thorax:** Black in ground color, brownish pollinose on the dorsum, gray on sides and anterior margin of mesonotum. Mesonotum and scutellum almost devoid of pile, the hind margin of the latter with scattered short hairs. Propleura bare. Humeri, tegulae and knobs of halteres blackish brown. **Legs:** Femora chiefly dark brown to black, apices and bases narrowly yellow. Trochanters, tibiae and tarsi brownish yellow. Curran described the legs of the type as black, knees narrowly reddish and tips of the tibiae and first two to three subsegments of anterior tarsi brownish red. The femora are slender, flexor bristles are present on the middle pair but absent on the front and hind femora. Tibiae without strong erect bristles on the outer surface or with apical spines. Tarsal claws and pulvilli small, not longer than the last subsegment of the tarsus. **Wings:** Lightly brownish fumose, stigma yellow brown and filling all of the third section of the costa. Third section slightly

longer than the fourth and almost as long as the fifth section. Crossvein r-m situated slightly below the basal third of the discal cell. Penultimate and ultimate sections of the fourth vein curved. Crossvein m equal in length to the last section of the fifth vein. Petiole of the cubital cell short, not longer than the r-m crossvein. **Abdomen:** Entirely opaque, with conspicuous silvery gray fascia on the posterior halves of segments two to five. The anterior margin of each of these segments is opaque brown, the brown color extends down the middle to the posterior border of the segment interrupting the gray fasciae. First tergum with a row of short black bristles on each side, other segments very sparsely haired. Sides of abdomen rounded, widest at segments three to four. **Hypopygium:** Seventh tergum large, well developed, occupying over one-fourth of the apex of abdomen from dorsal view. Eighth segment with a large apical membranous area slightly to the right side, this is half as broad as the segment (fig. 5c). The hypopygium, from above, is about equal in length to the fifth abdominal segment. The ninth segment (coxopodite) is yellow red in color, is greatly enlarged, from a lateral view it is larger than the eighth segment (fig. 5c). The sixth tergum is ventral in position and is more than half as long as the seventh. The outer harpago is very small and poorly developed, it is two times wider than long and about one-seventh as long as the strongly developed inner harpago. The inner is very greatly enlarged on apical half and curves up under the abdomen (figs. 5b).

**Length:** body, 4.5-5 mm.; wings, 5.5 mm.

**Female unknown.**

**Type locality:** Kortabo, British Guiana. Type in the American Museum.

The above described specimen was from Bartica, Br. Guiana, May 22, 1901 (H. S. Parish). It is in the Ohio State University Collection.

***Dorilas rubidus* n. sp.**

(Figs. 6a-b)

This species is related to *D. willistoni* (Kert.), it is readily distinguished from *D. cressoni* (Johnson) by the bristle like apices of the antennae and the difference in wing and genital characters.

**Female. Head:** Front almost equal in width to the face and slightly expanded medianly. Front chiefly gray, the upper two-thirds more obscurely so than the lower portion, middle of front with a narrow shining black line extending from ocellar triangle three-fourths its length. Face silvery gray pubescent, occiput cinereous. Mouthparts and antennae, except aristae beyond swelling, bright yellow. Bristles of second segment yellowish, not well developed. Apex of third segment produced into a long slender projection, this apical portion is longer than the remainder of the third segment and is two-thirds as long as the aristae (fig. 6a). **Thorax:** Dorsal portion brown in ground color and brown pollinose, pleura yellow. The humeri, tegulae and halteres are yellow. The propleura are not visible on the specimen at hand and it is not known whether or not it is haired. The scutellum has very weak marginal hairs. **Legs:** Entirely yellow, femora slender with flexor spines developed only on the middle pair. Tibiae without apical

spines and with no strong bristles on their outer sides. Tarsal claws and pulvilli small, about equal in length to the last subsegment. **Wings:** Hyaline, stigmata light brown and filling all of the third costal section. Third section two times longer than the fourth and approximately equal in length to the fifth section. Crossvein r-m situated at the middle of the discal cell, last section of the fourth vein strongly curved. Ultimate section of the fifth vein about one and one-half times longer than the m crossvein. Crossvein m slightly bent in the middle. Petiole of cubital cell slightly longer than the r-m crossvein. **Abdomen:** Chiefly subshining bright yellow, thinly gray to brownish pollinose. Entire venter and first tergum yellow. Terga two to five yellow except for a median brown spot. Sixth tergum brown except for yellow lateral margins. Only two moderately strong, widely spaced bristles present on each side of the first tergum. Abdomen very sparsely haired, sides almost straight, just slightly widest at about segment three. Sixth tergum not excised on hind margin. **Ovipositor:** Base elongate and reddish brown in color. Piercer yellow red, curved inwardly, slightly longer than its base and extending to the apex of the second abdominal segment (fig. 6b).

**Length:** body, 4.0 mm.; wings, 5.3 mm.

Male unknown.

**Holotype female:** Brasilien Nova Teutonia 1936 (Fritz Plaumann).

Type returned to the American Museum.

### ***Dorilas (Eudorylas) subjectus* (Collin)**

(Figs. 7a-l)

***Pipunculus subjectus* Collin, 1931, Konowia, X 171-173**

A female specimen is at hand which appears to belong to this species. There are a few discrepancies, however, between it and Collin's description of the male: there are no indications of apical spurs on the front tibiae, the subcostal vein (mediastinal of Collin) ends before the r-m crossvein and vein  $R_1$  (Collins' radial vein) ends about opposite the end of the discal cell.

**Female. Head:** Front broad, expanded at about the middle, at its widest point the front is one and one-third times wider than the face. Face and front chiefly silvery pubescent, front with a shining black median line extending from ocellar triangle three-fourths the length of the front. Occiput

### **EXPLANATION OF PLATES**

#### **Plate 1.**

- Fig. 1 **D. buscki** (Malloch). a. antenna; b. male hypopygium, dorsal; c. female ovipositor, lateral.  
 Fig. 2. **D. interruptus** (Malloch) a. male abdomen, dorsal; b. antenna  
 Fig. 3. **D. longiplius** n. sp. a. antenna, b. male hypopygium, dorsal.  
 Fig. 4. **D. mocaensis** n. sp. a. female ovipositor, lateral; b. antenna.

#### **Plate 2.**

- Fig. 5 **D. rex** (Curran). a. antenna; b. male harpagones; c. male abdomen, dorsal; d. male hypopygium, ventral; e. hypopygium from right side.  
 Fig. 6. **D. rubidus** n. sp. a. antenna; b. female ovipositor, lateral.  
 Fig. 7. **D. subjectus** (Collin). a. antenna; b. female abdomen, lateral.

PLATE I

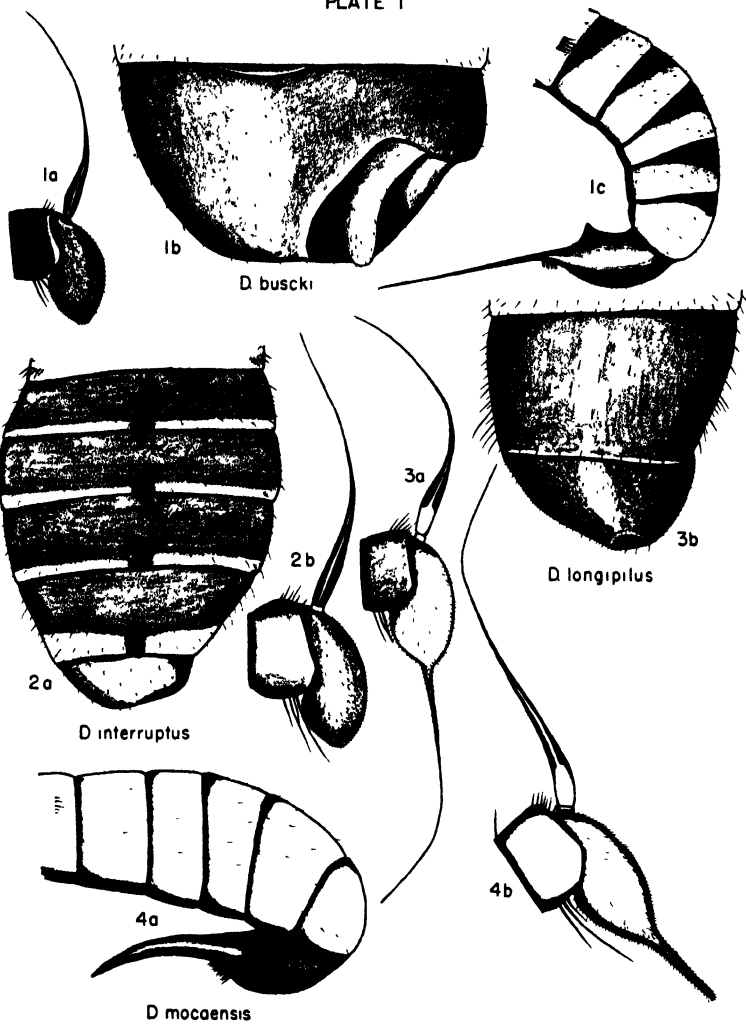
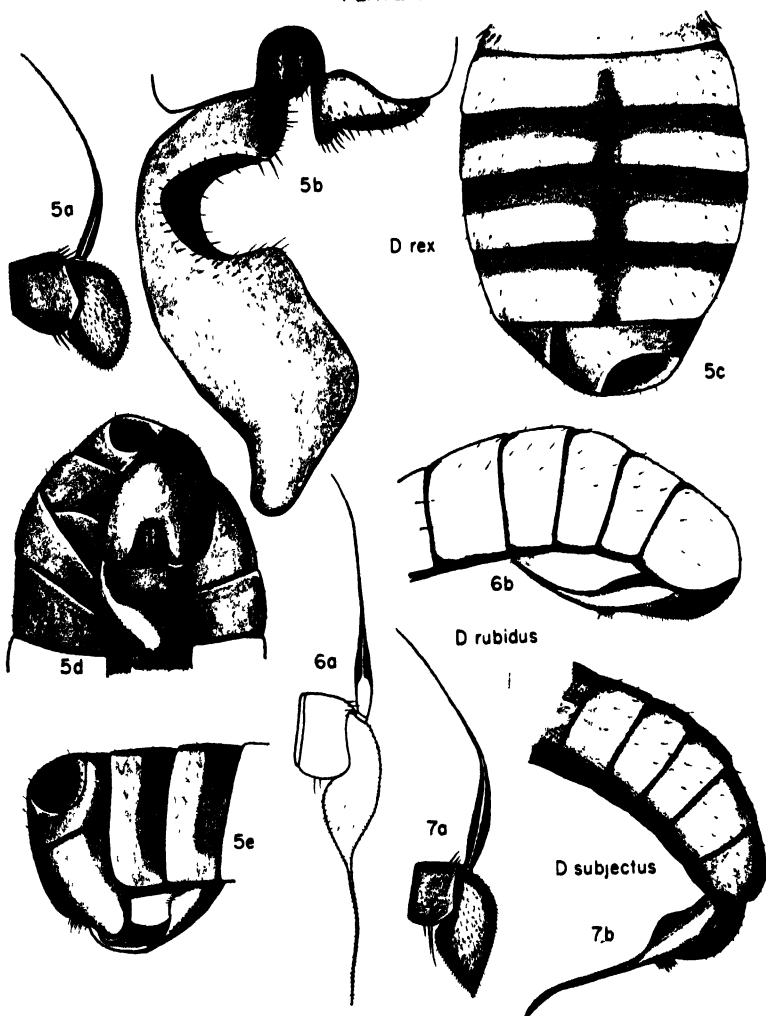


PLATE 2



gray, brownish above. First two antennal segments dark brown to black, bristles of second segment moderately developed. Third segment reddish brown, acute at apex (fig. 7a). **Thorax:** Dorsum subshining black in ground color, gray dusted. Humeri black, tegulae yellow, halteres chiefly yellow with the knobs slightly brownish red. Propleura bare, dorsocentral and marginal scutellar hairs small and inconspicuous. **Legs:** Coxae, trochanters and femora chiefly dark brown to blackish, apices of femora yellow. Broad apices and bases of tibiae yellow, discolored with brown medjanly. Tarsi chiefly yellow, last subsegment brownish. Femora moderately stout, flexor spines present but not strongly developed. No apparent apical spurs or strong lateral bristles on tibiae. Tarsal claws and pulvilli small, not much longer than the last subsegment. **Wings:** Hyaline, stigma light yellow brown, not quite filling all of the third costal section. Third section equal in length to the fourth, the two combined are slightly longer than the fifth section. The r-m crossvein is situated at about the basal three-sevenths of the discal cell and the last section of the fourth vein is almost straight. **Abdomen:** Short, rather rounded, widest at about segment three. Subshining black, lightly brownish pollinose on the dorsum, grayish on the sides. Abdomen very sparsely covered with short dark hairs. First tergum with two to three strong black bristles on each side. Hind margin of sixth tergum straight, not excised. **Ovipositor:** Base elongate, dark brown to black and grayish pollinose above. Piercer yellow red, long, slender and slightly curved upward (fig. 7b). The piercer is two times longer than its base and extends to the base of the abdomen.

**Length:** body, 3.2 mm.; wings, 4.0 mm.

**Type locality:** Bolivia, Villa Montes.

The female specimen described above was from Bolivia, Prov. Tara (Steinbach).

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## AN UNDESCRIBED ANOMIOPSYLLUS BAKER FROM THE PACK RAT, NEOTOMA MICROPUS BAIRD

R. H. EADS and G. C. MENZIES

Bureau of Laboratories

Texas State Department of Health, Austin, Texas

A large series (Table 1) of an apparently undescribed flea of the genus *Anomiopsyllus* Baker has been taken in West Texas in sylvatic plague investigations conducted by the United States Public Health Service and the Texas State Department of Health. This unusual genus has no eyes, both genal and pronotal combs are absent and the number of setae are greatly reduced.

*Anomiopsyllus hiemalis*, n. sp.

**Holotype male:** Clypeus evenly rounded, frontal tubercle prominent, well sclerotized; four-segmented labial palpi extend slightly beyond fore coxae; preantennal region with inconspicuous row of three bristles (middle one

small) and single small bristle on margin of antennal fossa; scape of antenna with three setae, pedicle with four setae which extend less than one-fourth the length of the clava; postantennal region of head glabrous with exception of one large and one small bristle on margin of antennal fossa and a row of four bristles on posterior margin; pro-, meso-, and metathorax each with one row of three or four fine bristles; each abdominal tergite with three or four bristles in a single row, first tergite with an additional row of three prominent teeth on caudal margin (two in some paratypes), second tergite with one caudal tooth; single antepygidial bristle per side; abdominal sternites with one or two bristles; last tarsal segment of legs with four lateral plantar bristles, each femur with one lateral bristle: second tarsal segment of third pair of legs with two setae as long as last three tarsal segments. **Modified Segments:** VIII sternite without distal process, one large bristle toward ventro-caudal margin; IX sternite (Fig. 4) with a distal arm not well defined into lobes, at apex a row of three spiniforms, approximately twenty bristles scattered over posterior two-thirds of arm; immovable process of clasper (Fig. 5) with single acetabular bristle at base, at apex a stout bristle and seven or eight smaller ones; movable finger of clasper (Fig. 5) broad and conical, with three spiniforms toward posterior border, the middle one somewhat closer to dorsal spiniform, toward apex numerous small bristles present, four bristles on posterior border between the second and third spiniforms; hairs on pygidium reduced in number and very long.

**Allotype female:** General chaetotaxy similar to male in most respects; bristles of pedicle of antenna reach over one half length of clava; first abdominal tergite with only two teeth on posterior margin and none on second abdominal tergite. **Modified Segments:** VII sternite (Fig. 2) with posterior margin divided into two lobes by a shallow sinus; spermatheca with body roughly globular and with slightly curved arm larger than body; anal style (Fig. 1) about three times as long as width at base, a long bristle and two very short ones at apex.

**Type locality:** Gaines County, Texas.

**Type host:** *Neotoma micropus* Baird

**Types:** Holotype male collected by V. I. Miles, April 23, 1948. Allotype female by same collector, April 9, 1948.

**Paratypes:** Two males from Lamb County, Texas, by V. I. Miles, Nov. 22, 1947; two males from Terry County, Texas, by V. I. Miles, Jan. 6, 1948; two males and three females from Yoakum County, Texas, by G. H. Halyard, Aug. 14, 1947; two females from Dawson County, Texas, September 23, 1947 and one female October 3, 1947, by G. H. Halyard.

The holotype and allotype have been deposited in the United States National Museum, Washington, D. C. Paratypes have been sent to the Communicable Disease Center, Public Health Service, Atlanta, Georgia; Mr. Frank M. Prince, Plague Suppressive Laboratory, Public Health Service, San Francisco, California; Dr. William L. Jellison, Rocky Mountain Laboratory, Public Health Service, Hamilton, Montana; and Major Robert Traub, Medical Center, Washington, D. C.

This species appears to be most closely related to *Anomiopsyllus nudatus* Baker. In *A. nudatus* the two dorsally placed spiniforms of the movable finger of the male clasper are adjacent to one another; in *A. hiemalis* the middle spiniform is spaced more nearly equidistant between the dorsal and ventral spiniforms.

In addition to the type host, *A. hiemalis* has occasionally been taken from *Onychomys leucogaster* (Coues), grasshopper mouse; *Dipodomys ordii* Woodhouse, kangaroo rat; and *Sylvilagus auduboni* (Baird), cottontail rabbit.

Data on twelve-month's collections of *Neotoma* and the numbers of *A. hiemalis* taken from them are given in Table 1. A total of 2,126 packrats were taken; 371 were infested with *A. hiemalis*, with an average of 3.44 fleas per infested animal.

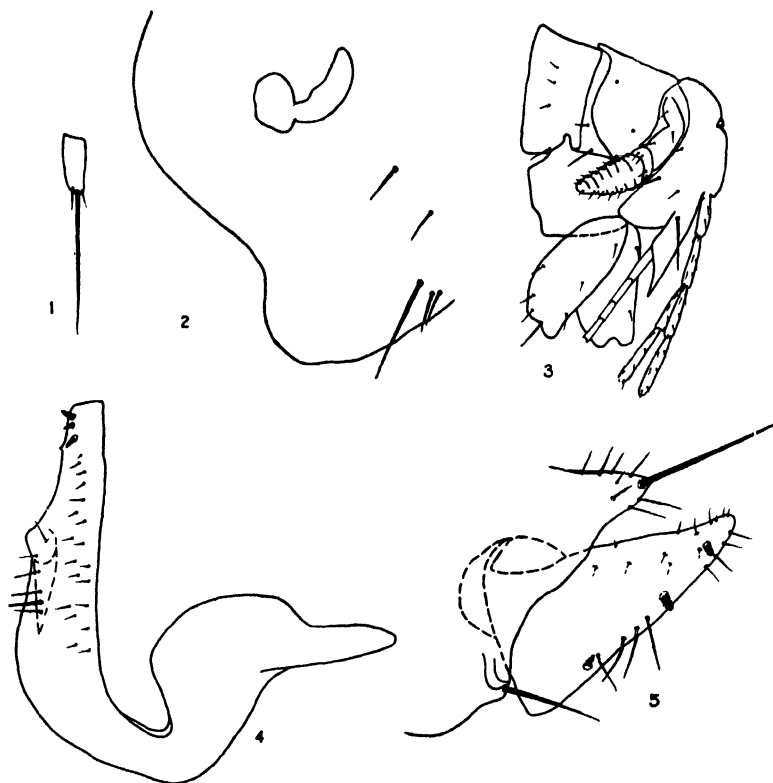
In addition to trapping the pack rats, nine of their nests were examined. Only six *Anomiopsyllus* were taken although the common *Neotoma* flea, *Orchopeas sexdentatus* Baker, was present in greater numbers. *Echidnophaga gallinacea* Westwood and *Hoplopsyllus affinis* Baker were also recovered from the nests.

Mr. F. M. Prince, Plague Suppressive Laboratory, Public Health Service and Major Robert Traub, Army Medical School Washington, D. C., were very helpful in determining the specific status of this flea. Mr. Prince loaned a drawing made by the late Dr. Alfonso Dampf of an *Anomiopsyllus* which he had taken in Mexico near the Texas border. It was not unlike the form described here as *A. hiemalis*. As far as we have been able to determine, Dr. Dampf had not published a description of his Mexican form.

Table 1

Date	Number of <i>Neotoma</i> Taken	Number of <i>Neotoma</i> with <i>A. hiemalis</i> <i>A. hiemalis</i>	Number of <i>Neotoma</i>	Fleas per Infested Rat	Percent of Infested Animals
August 1947	68	6	12	2	9
September	45	7	15	2.14	16
October	114	14	53	3.78	12
November	35	5	22	4.5	14
December	31	2	3	1.5	6
January 1948	55	10	82	8.2	18
February	186	21	52	2.47	11
March	253	56	360	6.42	22
April	398	144	492	4.11	36
May	280	73	131	1.79	26
June	285	18	40	2.21	6
July	376	15	15	1	4
Total	2,126	371	1,277	3.44	12.7



**EXPLANATION OF PLATE**

*Anomlopsyllus hiemalis* n. sp.: Fig. 1. female anal stylet; Fig. 2 female seventh sternite; Fig. 3 male head; Fig. 4. male IX sternite; Fig. 5. process and movable finger of male clasper.

**TWO NEW SPECIES OF MALLOPHAGA****K. C. EMERSON**

Oklahoma A. and M. College, Stillwater, Oklahoma.

**Lagopoecus obscurus n. sp.**

(Figures 1-3)

**Female.** Clypeal margin evenly rounded, and with scattered small setae. Eye prominent, with a long seta arising from the dorsal surface. Temples convexly rounded, each with two long setae; cephalic margin without setae. Prothorax short, wide, and armed dorsally with one long seta on each posterolateral angle. Pterothorax twice as wide as long. Dorsal posterior pterothoracic setae as shown in figure 1. Abdominal segments with brown areas on lateral margins as shown in figure 1. Abdominal tergal plates each with four long median setae, one or two pairs of long setae on the posterolateral angles, and on segments two to six, one pair of long setae medial to the dark areas. Chaetotaxy of the posterior segments as shown in figure 1.

**Male.** Head approximately the same size as in the female. Thorax and abdomen essentially the same shape, as in the female, but smaller. Chaetotaxy, except for the posterior abdominal segments, same as in the female. Genitalia as shown in figure 3.

**Type Host:** *Dendragapus obscurus richardsonii* (Douglas), Richardson's Grouse.

**Type Material:** Holotype male and allotype female, collected by Dr. William L. Jellison, from the Tin Cup District, Ravalli Co., Montana. Paratypes from the same collection and from the type host collected in the Harlan District, Ravalli Co., Montana.

**Discussion:** This form is very closely related to *L. lyrurus* Clay, from *Lyrurus tetrix tetrix* and *L. gibsoni* Hopkins, from *Centrocercus urophasianus*. Both of the above-mentioned species have six long median setae on each abdominal tergal plate and two pairs of long setae on the posterolateral angles on each abdominal tergal plate and three pairs of long setae on the posterolateral angles of the pterothorax.

**Colinicola mearnsi n. sp**

(Figures 4-6)

**Female:** Head circumfasciate with clypeal margin evenly rounded. Trabeculae well developed. Antennae filiform, the second segments being the longest. Temples rounded but not expanded or produced. Prothorax short, with one long dorsal seta in each posterolateral angle. Pterothorax longer than prothorax, widest at the posterior margin. Abdomen oval. Tergal plates prominent, separated medianly, and each with a row of setae on the posterior margin. Dorsal and ventral chaetotaxy as shown in figure 4.

**Male:** Similar to the female in size and shape, there being little sexual dimorphism. First antennal segments enlarged but without appendages; second segments each with a slight hook on the distal end; third segments prominently curved, fourth segments produced at angles. Chaetotaxy as shown in figure 5. Genitalia very unusual, as shown in figure 6.

**Type Host:** *Cyrtonyx montezumae mearnsi* Nelson, Mearns's Quail.

**Type Material:** Holotype male, allotype female, and paratypes of both sexes, collected by Dr. A. R. Phillips at Nogales, Arizona.

**Discussion:** This species differs from the generic description given by Carriker in that the pterothorax is longer than the prothorax and the male genitalia are entirely different. The male genitalia (figure 7) of *Colinicola numidianus* (Denny), genotype, are typical for the genus. Figures 6 and 7 illustrate the greatest difference between the new form and the other species in the genus. Although this form does not agree entirely with Carriker's description of the genus, it is believed that it is properly placed.

#### EXPLANATION OF PLATES

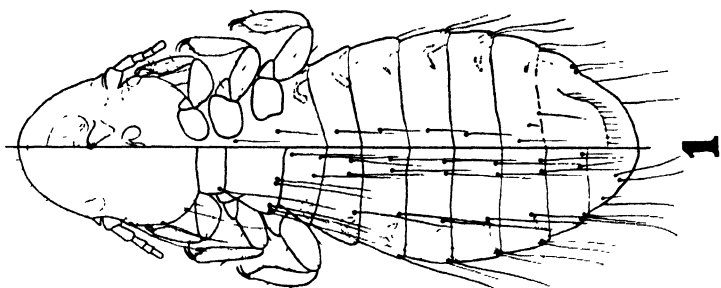
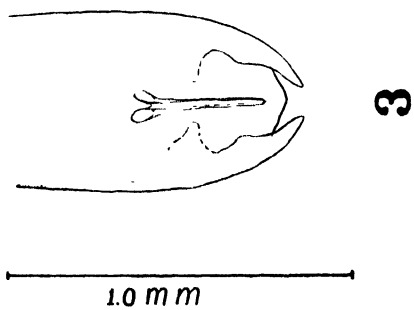
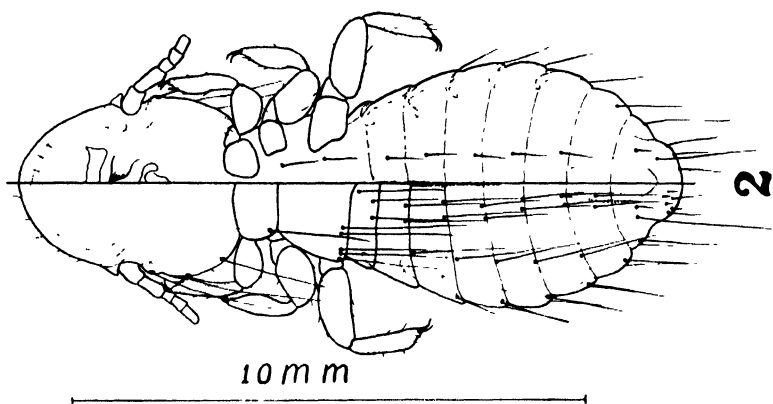
##### Plate I

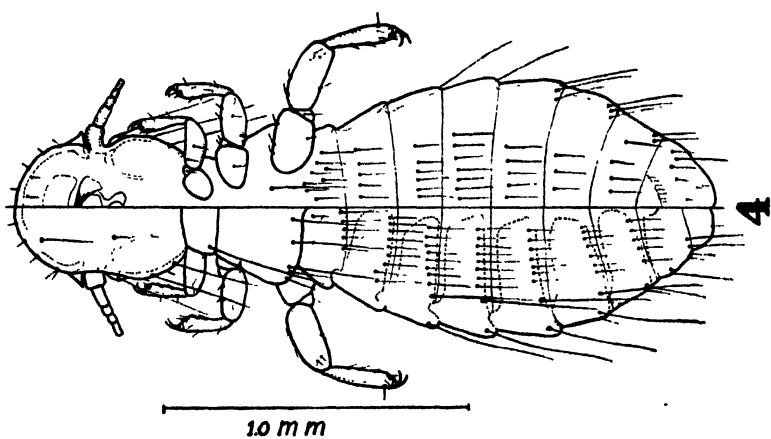
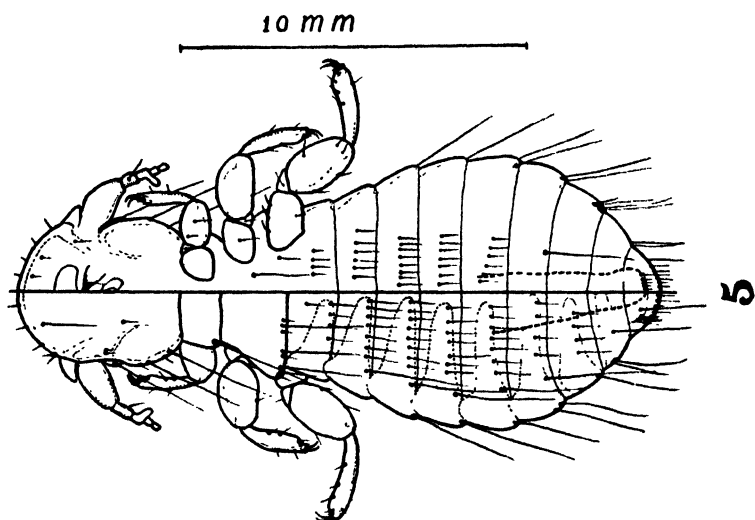
All figures refer to *Lagopoecus obscurus* n. sp.:

1. Dorsal-ventral view of the female.
2. Dorsal-ventral view of the male
3. Male genitalia.

##### Plate II

4. Dorsal-ventral view of the female of *Colinicola mearnsi* n. sp.
5. Dorsal-ventral view of the male of *Colinicola mearnsi* n. sp.
6. Male genitalia of *Colinicola mearnsi* n. sp.
7. Male genitalia of *Colinicola numidianus* (Denny).





## THE EGGS OF CORIXIDAE (HEMIPTERA)

By H. B. HUNGERFORD\*

Lawrence, Kansas

In "The Corixidae of the Western Hemisphere"<sup>1</sup> on page 17 I stated that I could not accept the proposal to make the subfamily Micronectinae a separate family, Micronectidae, until I had seen the eggs of *Tenagobia* which undoubtedly is a genus belonging in the Micronectinae. *Tenagobia* occurs in the western hemisphere and is the counterpart of the *Micronecta* of the old world. In text figure 1 on page 13 of the above work I reproduced Doctor Poisson's drawings of the eggs of two species of *Micronecta*. These are indeed very different from other corixid eggs in shape. They are attached flatwise along their longitudinal axis and lack a stalked pad. At that time I had no information about *Tenagobia* eggs.

After "The Corixidae of the Western Hemisphere" had gone to press, we discovered that the eggs in dried and pinned gravid females were in good condition for study. By dropping an abdomen containing fully developed eggs into hot caustic potash for a brief period (one minute or less depending on the size of the insect), it was possible to restore them to their normal size and appearance. After drawings and measurements were made, the eggs were thoroughly washed in water and mounted directly from it into highly concentrated polyvinyl alcohol. In this manner we were able to study the eggs of 30 species of Corixidae in 19 different genera, including *Tenagobia*.

The eggs of *Tenagobia*, unlike those of *Micronecta*, are attached to their support by means of a long, slender stalk such as is possessed by *Cymatia*. In view of this, a family rank for the Micronectinae seems inadmissible.

In several instances the eggs were found in the genital chamber. From the position there, the eggs apparently leave the body of the female stalk end first and are then glued to submerged objects. Brief descriptions of the eggs examined follow.

1. *Tenagobia selecta* (White). Total length of egg (including stalk) .86 mm.; length of micropyle .04 mm.; length of stalk .36 mm.; diameter of egg .32 mm. The eggs are a greyish yellow in color, without apparent sculpturing. (All eggs herein described are numbered according to their order on the plates. For *T. selecta*, see Plate I, fig. 1).

2. *Stenocorixa protrusa* Horvath. Total length of egg 1.15 mm.; length of micropyle .03 mm.; length of stalk .09 mm.; diameter of egg .58 mm. While in most of the other eggs studied, the stalk and egg seem to be distinct from one another, the egg of *S. protrusa* is firmly united with the stalk with no apparent line of division. The eggs are a deep golden brown, much darker than the other eggs studied, and the surface is minutely punctate or sculptured.

3. *Cymatia americana* Hussey. Total length 1.41 mm.; length of micropyle

\* Contribution from the Department of Entomology, University of Kansas

<sup>1</sup> University of Kansas Science Bulletin, Vol. XXXII.

.03 mm.; length of stalk .79 mm.; diameter .60 mm. Color pale yellowish tan with no sculpturing.

4. *Heterocorixa chapadiensis* Hungerford. Total length 1.01+ mm.; length of micropyle .01 mm.; length of stalk (broken) .32+ mm.; diameter .46 mm. Color pale yellowish tan, no sculpturing; stalk clear. Shape elongate oval.

5. *Heterocorixa hesperia venezuelana* Hungerford. Total length 1.34 mm.; length of micropyle .01 mm.; length of stalk .72 mm.; diameter .56 mm. Color pale yellowish tan; not sculptured; shape rounded.

6. *Dasycorixa rawsoni* Hungerford. Total length 1.15 mm.; length of micropyle .12 mm.; length of stalk .10 mm.; diameter .84 mm. Color golden brown; finely sculptured; shape elongate oval.

7. *Graptocorixa melanogaster* (Kirkaldy). Total length 1.27 mm.; length of micropyle .12 mm.; length of stalk .04 mm.; diameter .85 mm. Color pale yellowish tan; shape oval; not sculptured.

8. *Graptocorixa abdominalis* (Say). Total length 1.30 mm.; length of micropyle .12 mm.; length of stalk .04 mm.; diameter .98 mm. Color pale yellow; shape oval; not sculptured.

9. *Graptocorixa serrulata* (Uhler). Total length .69 mm.; length of micropyle .06 mm.; length of stalk .03 mm.; diameter .49 mm. Color pale yellow; shape oval; not sculptured.

10. *Ectemnostegella peruana* Jaczewski. Total length 1.22 mm.; length of micropyle .09 mm.; length of stalk .07 mm.; diameter .58 mm. Color pale yellow; shape elongate oval; not sculptured.

11. *Krizousacorixa femorata* (Guérin-Ménéville). Total length .86 mm.; length of micropyle .06 mm.; length of stalk .09 mm.; diameter .36 mm. Color yellowish tan; shape elongate oval; surface minutely pitted or sculptured.

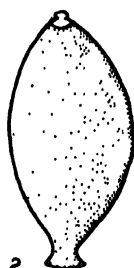
12. *Krizousacorixa azteca* Jaczewski. Total length .65 mm.; length of micropyle .06 mm.; length of stalk .03 mm.; diameter .40 mm. Color yellowish tan; shape elongate oval; surface minutely punctate. The eggs of *K. azteca* have shorter stalks than do those of *K. femorata*, and are somewhat broader in proportion to their length.

#### PLATE I.

- 1 *Tenagobia selecta* (White).
- 2 *Stenocorixa protrusa* Horvath.
- 3 *Cymatia americana* Hussey.
- 4 *Heterocorixa chapadiensis* Hungerford (stalk broken).
- 5 *Heterocorixa hesperia venezuelana* Hungerford
- 6 *Dasycorixa rawsoni* Hungerford.
- 7 *Graptocorixa melanogaster* (Kirkaldy).
- 8 *Graptocorixa abdominalis* (Say)
- 9 *Graptocorixa serrulata* (Uhler).
- 10 *Ectemnostegella peruana* Jaczewski
- 11 *Krizousacorixa femorata* (Guérin-Ménéville)
- 12 *Krizousacorixa azteca* Jaczewski
- 13 *Palmarcorixa buenoi* Abbott
- 14 *Palmarcorixa gillettei* Abbott.
- 15 *Trichocorixa naias* (Kirkaldy).



1  
*Tenagobia*  
*selecta*



2  
*Stenocorixa*  
*protrusa*



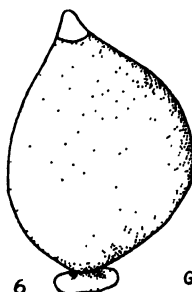
3  
*Cymatia*  
*americana*



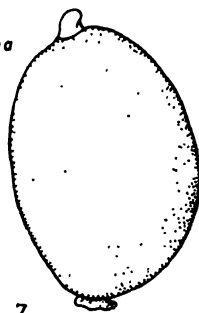
4  
*Heterocorixa*  
*chapadiensis*



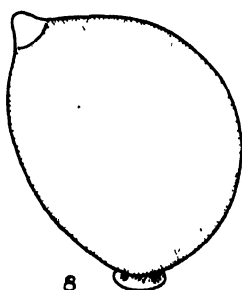
5  
*H. hesperia*  
*venezuelana*



6  
*Dasycorixa*  
*rawsoni*



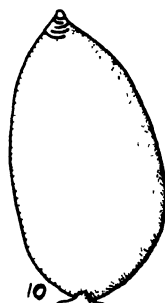
7  
*Graptocorixa*  
*melanogaster*



8  
*G. abdominalis*



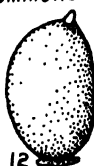
9  
*G. serrulata*



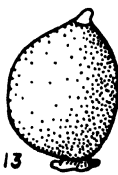
10  
*Ectemnostegella*  
*peruana*



11  
*Krizousacorixa*  
*femorata*



12  
*K. azteca*



13  
*Palmacorixa*  
*buenoi*



14  
*P. gillettei*



15  
*Trichocorixa*  
*naia*



13. *Palmarcorixa buenoi* Abbot. Total length .72 mm.; length of micropyle .07 mm.; length of stalk .04 mm.; diameter .49 mm. Color pale, clear yellow; shape elongate oval; not sculptured.

14. *Palmarcorixa gillettei* Abbott. Total length .57 mm.; length of micropyle .03 mm.; length of stalk .04 mm.; diameter .37 mm. Color pale yellow; shape oval; not sculptured.

15. *Trichocorixa naias* (Kirkaldy). Total length .50 mm.; length of micropyle .04 mm.; length of stalk .03 mm.; diameter .42 mm. Color pale yellow; shape oval; not sculptured.

16. *Corisella decolor* (Uhler) [= *dispersa* (Uhler)]. Total length .74 mm.; length of micropyle .07 mm.; length of stalk .07 mm.; diameter .43 mm. Color pale yellow; shape oval; stalk short and stout; not sculptured.

17. *Corisella edulis* (Champion). Total length 1.27 mm.; length micropyle .12 mm.; length of stalk .07 mm.; diameter .72 mm. Color pale yellowish tan; shape elongate oval; stalk more slender than in *C. decolor*; not sculptured.

18. *Centrocorisa kollarii* (Fieber). Total length of egg .98 mm.; length of micropyle .04 mm.; length of stalk .07 mm.; diameter .68 mm. Color yellowish tan; shape oval; not sculptured.

19. *Pseudocorixa beameri* (Hungerford). Total length 1.01 mm.; length of micropyle .10 mm.; length of stalk .09 mm.; diameter .68 mm. Color yellowish tan; shape oval; not sculptured.

20. *Callicorixa noorvikensis* Hungerford. Total length .88 mm.; length of micropyle .06 mm.; length of stalk .07 mm.; diameter .58 mm. Color pale yellow, shape elongate oval; sculptured in hexagonal mosaics.

21. *Hesperocorixa mandshurica* (Jaczewski) Total length 1.05 mm.; length of micropyle .06 mm.; length of stalk .07 mm.; diameter .71 mm. Color pale yellow; shape round; not sculptured.

22. *Xenocorixa vittipennis* (Horvath). Total length 1.01 mm.; length of micropyle .04 mm.; length of stalk .04 mm.; diameter .49 mm. Color pale yellowish tan; shape elongate oval; surface minutely wrinkled.

23. *Arctocorisa lawsoni* Hungerford. Total length .92 mm.; length of micropyle .09 mm.; length of stalk .04 mm.; diameter .65 mm. Color pale yellowish tan; shape elongate oval; not sculptured.

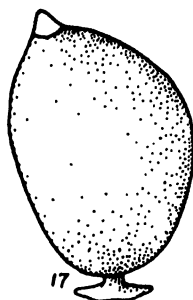
#### PLATE II.

- 16 *Corisella decolor* (Uhler) [= *dispersa* (Uhler)].
- 17 *Corisella edulis* (Champion).
18. *Centrocorisa kollarii* (Fieber).
19. *Pseudocorixa beameri* (Hungerford).
20. *Callicorixa noorvikensis* Hungerford
21. *Hesperocorixa mandshurica* (Jaczewski).
22. *Xenocorixa vittipennis* (Horvath).
- 23 *Arctocorisa lawsoni* Hungerford.
24. *Cenocorixa bifida* (Hungerford).
25. *Sigara* (*Vermicorixa*) *alternata* (Say).
26. *Sigara* (*Phacosigara*) *paludata* Hungerford
27. *Sigara* (*Subsigara*) *distincta* (Fieber).
28. *Sigara* (*Tropocorixa*) *meridionalis* (Wallengren).
29. *Sigara* (*Tropocorixa*) *irrorata* (Fieber).
30. *Sigara* (*Allosigara*) *decorata* (Abbott).



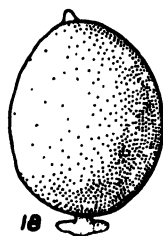
16

*Corisella*  
*decolor*



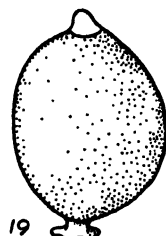
17

*C. edulis*



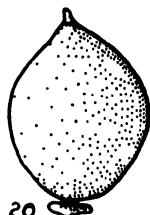
18

*Centrocorisa*  
*kollarii*



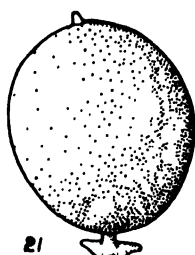
19

*Pseudocorisella*  
*beameri*



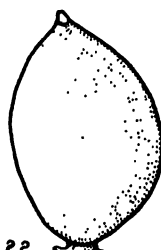
20

*Cellicorisella*  
*noorvikensis*



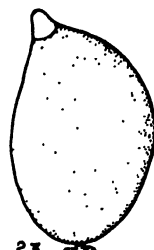
21

*Hesperocorisella*  
*mandshurica*



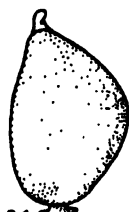
22

*Xenocorisella*  
*vittipennis*



23

*Arctocorisella*  
*lawsoni*



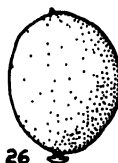
24

*Cenocorisella*  
*bifida*



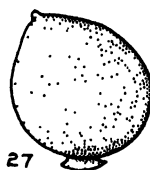
25

*Sigara alternata*



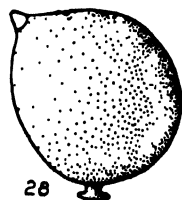
26

*S. paludata*



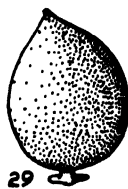
27

*S. distincta*



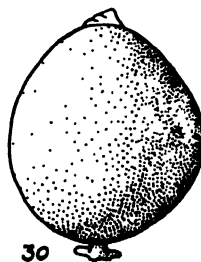
28

*S. meridionalis*



29

*S. irrorata*



30

*S. decorata*

A. M. Egbert del.

24. *Cenocorixa bifida* (Hungerford). Total length .89 mm.; length of micropyle .07 mm.; length of stalk .03 mm.; diameter .50 mm. Color pale yellow; shape elongate oval; not sculptured.

25. *Sigara* (*Vermicorixa*) *alternata* (Say). Total length .55 mm.; length of micropyle .04 mm.; length of stalk .04 mm.; diameter .35 mm. Color pale yellow; shape oval; not sculptured.

26. *Sigara* (*Phaeosigara*) *paludata* Hungerford. Total length .65 mm.; length of micropyle .01 mm.; length of stalk .03 mm.; diameter .50 mm. Color pale yellow; shape rounded; surface minutely wrinkled.

27. *Sigara* (*Subsigara*) *distincta* (Fieber). Total length .68 mm.; length of micropyle .01 mm.; length of stalk .03 mm.; diameter .60 mm. Color yellowish tan; shape oval; not sculptured.

28. *Sigara* (*Tropocorixa*) *meridionalis* (Wallengren). Total length .86 mm.; length of micropyle .08 mm.; length of stalk .07 mm.; diameter .72 mm. Color pale yellowish tan; shape oval; surface minutely wrinkled.

29. *Sigara* (*Tropocorixa*) *irrorata* (Fieber). Total length .75 mm.; length of micropyle .03 mm.; length of stalk .06 mm.; diameter .50 mm. Color pale yellowish tan; shape elongate oval; surface minutely wrinkled.

30. *Sigara* (*Allosigara*) *decorata* (Abbott). Total length .96 mm.; length of micropyle .07 mm.; length of stalk .07 mm.; diameter .86 mm. Color pale yellowish tan; shape rounded; not sculptured.

**Summary:** From what little we now know about the eggs of Corixidae, those of *Micronecta* are unique and do not follow the usual corixid pattern, while those of *Tenagobia* are on elongated stalks and are shaped like those of *Cymatia*, *Heterocorixa* and *Agraptocorixa*. However different the eggs of *Tenagobia* are from those of *Micronecta*, these two genera are structurally so much alike that they must belong in the same subfamily. The *Micronectinae* should therefore be retained as a subfamily of Corixidae until more convincing evidence is presented than we have at present.

---

## APHIDS FROM THE WEST

GEORGE F. KNOWLTON

Utah State Agricultural College, Logan.

The following host and distribution records deal with aphids, many of which are incompletely known in most western states.

**Pterocomma populea** (Kalt.), accidental alate on potato, Toppenish, Washington, May 28, 1947; Twin Falls, Idaho; Mt. Nebo, Utah, July 12, 1942 (Knowlton).

**Clavigerus beulahensis** (Ckl.) on **Populus**, Big Cottonwood Canyon, Utah., June 25, 1925; Bear River City, Utah, May 13, 1930 (Knowlton).

**C. bicolor** (Oest.) on **Salix**, Cedar Breaks, Utah, at 10,500 ft. elevation, July 8, 1925 (Knowlton); accidental alate on apricot, Union Gap, Washington, November 7, 1947; Twin Falls, Idaho, on weeping willow, June 19, 1941, (J. R. Douglass)

**C. populifoliae** (Fitch) on **Populus**, Morgan and Hyde Park, Utah, June, 1925 (Knowlton); Beaverdam, Arizona, April 25, 1935 (Knowlton); accidental alate on **Salix** at Union Gap, Washington, November 7, 1947.

**C. salicis** (L.) on **Salix** at Auburn, Washington August 6, 1937 (H. C. Bennion).

**C. smithiae** (Monell) on **Populus**, Manhattan, Montana, August 14, 1926 (C. B. Phillip); **Salix**, Union Gap, Washington, November 7, 1947; damaging weeping willow at Twin Falls, Idaho, June 19, 1941 (J. R. Douglass); **Populus angustifolia**, Mt. Nebo, Utah, July 12, 1942 (Knowlton).

**Aphis artemisicola** Wms on **Artemisia tridentata**, Cameron Pass, Colorado, August 22, 1940 (Knowlton)

**A. bakeri** Cowen on peach and apricot, Union Gap, Washington, September and November, 1947.

**A. canae** Wms. on **Artemisia tridentata**, Yellowstone National Park, Montana, July 15, 1936 (Knowlton).

**A. corbocolor** Gill. on **Rumex crispus**, Cornish, Utah, June 27, 1935 (Knowlton—C. F. Smith); **Rumex**, St. Mary's Lake, Montana and Jackson, Wyoming, July, 1946 (Knowlton); Union Gap, Washington, July 8, 1947.

**A. cardui** L., an accidental alate on gooseberry, Farmington, Utah, September 17, 1941 (Knowlton—W. D. Fronk); **Carduus**, Afton, Wyoming, July 20, 1946 (Knowlton); prune and apricot Union Gap, Washington, November 7, 1947

**A. cerasifoliae** Fitch in twisting leaves of **Prunus melanocarpa**, Spanish Fork Canyon and Soldier Summit, Utah, June 9, 1946 (Knowlton).

**A. chrysothani** Wilson on **Chrysothamnus**, Hubbard Ranch, Nevada, August 20, 1943 (Knowlton); on **C. nauseosus** at Hooper, Honeyville and Ogden, Utah.

**A. frangulae** Kalt. on **Nepeta cataria**, Wells, Nevada, August 20, 1943 (Knowlton); Beaver Mt., Utah, July 10, 1942; Twin Falls, Idaho, August 19, 1943 and Whipple, Arizona, May 6, 1945 (Knowlton).

**A. gossypii** Glover on cantaloupe and **Rumex crispus**, Glendale, Nevada, April 25, 1941 (Knowlton); damaging watermelons, Toquerville, Moab and

Castle Valley, Utah; *Capsella bursa-pastoris*, Beaver Dam, Arizona, May 25, 1935 (Knowlton); accidental on *Rosa*, Bonneville Dam, Oregon, July 20, 1939 (Knowlton).

*A. gregalis* K. on *Chrysothamnus viscidiflorus lanceolatus*, Hansels' Mts., Utah., August, 1945 (Knowlton); *Tabiona*, Utah, September 2, 1937 (Knowlton).

*A. helianthi* Monell on *Helianthus annuus*, Shoshone, Wyoming, September 13, 1941 (Knowlton—H. F. Thornley); in stomach of a lizard, *Uta stansburiana stansburiana* (B.-G.), at Gusher, Utah, August 5, 1932; Wells, Nevada, August 16, 1945, and Great Falls, Montana, August 4, 1944 (Knowlton); Hurrah, Washington, July 9, 1947.

*A. lugentis* Wms. on sneezeweed, Mt. Timpanogos, Utah, July 26, 1945, (Knowlton).

*A. maculatae* Oest. on *Populus sargentii*, Circleville, Utah, July 11, 1942, and Naples, Utah, July 25, 1945 (Knowlton).

*A. maidi-radicis* Forbes on corn roots at Roosevelt, 1941, Farmington, 1936 and Castle Valley, July 26, 1936 in Utah (Knowlton).

*A. maidis* Fitch on grass at Zion National Park, Utah, July 4, 1946; Tucson, Arizona and Naco, Mexico, during late March, 1945 (Knowlton); infesting oats and barley in Dallas, Texas, December 18, 1942 (A. B. Jolley—J. N. Roney).

*A. marutae* Oest. on *Cirsium*, Toppenish, Washington, July 9, 1947.

*A. medicaginis* Koch on sweetclover, Casa Grande, Arizona, March 24, 1945 (Knowlton); spinach, Moscow, Idaho, July (T. A. Brindley); *Rumex*. Glendale, Nevada (Knowlton); alfalfa, Graybull, Wyoming, September 12, 1941 (Knowlton); on dodder, Logan, Utah, August 23, 1927 (Knowlton).

*A. middletoni* Thomas on corn roots at Moab, Utah; feeding on dodder. Logan, Utah, August 23 and September 18, 1927 (Knowlton); on roots and crown of *Tragopogon pratensis*, North Logan, Utah, October 10, 1926 and September 16, 1927 (Knowlton).

*A. monardae* Oest. on *Monarda*, Monte Cristo, Utah, August 21 and Emigration Canyon, Idaho, August 14, 1942; Logan Canyon, Utah, August 16, 1927, curling *Monarda* leaves (Knowlton).

*A. oenotherae* Oest. on *Oenothera biennis*, Zion National Park, Utah, July 10, 1925 (Knowlton); Mt. Rainier, Washington (H. C. Bennion).

*A. rosae* (Baker) in curled apple leaves, Provo, Farmington, Salt Lake City, causing damage in spring of 1945 (Knowlton—C. D. Ashton); Wendell, Idaho.

*A. rubicola* Oest. on wild raspberry, Shoshone National Forest, Wyoming, September 11, 1941 (Knowlton); black raspberry, Puyallup, Washington, June 19, 1939 (Knowlton); red raspberry, Pleasant Grove, Utah, July 7, 1937 (Knowlton—L. L. Hansen).

*A. rumicis* L. infesting 40 acres of sugar beets near Medford, Oregon, June 13, 1939 (D. C. Mote); burdock, Moscow, Idaho, July 2, 1941 (T. A. Brindley); alates on tomato, Overton, Nevada, May 20, 1935 (Knowlton); *Cucurbita*, Union Gap, Washington, July 8, 1947.

**A. sambucifoliae** Fitch at Manassa, Colorado, July 28, 1943 (B. A. Haws).  
**A. sedi** Kalt. on *Sedum*, Puyallup, Washington, July 27, 1937 (H. C. Bennion).

**A. setariae** (Thomas) on grass, Woodro, Wyoming, September 11, 1941 (Knowlton); Vernal, Utah, August 17, 1940.

**A. spiraeicola** Patch on *Spiraea*, in damaging abundance during spring of 1945, 1946 and 1947 at Logan, Springville, Farmington and Brigham, Utah; Helena, Montana, July 28, 1946 (Knowlton); Lethbridge and Waterton National Park, Alberta, Canada, late July of 1946 (Knowlton); Puyallup, Washington (H. C. Bennion).

**A. viburnicola** Gill. on *Viburnum opulus*, Liberty, Utah, October 9, 1937; and Logan, Ogden and Salt Lake City, spring of 1946; Preston, Idaho (Knowlton).

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